66TH CONGRESS
1st Session

HOUSE OF REPRESENTATIVES

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No. 262

Development of Unused Lands

LETTER

FROM

THE SECRETARY OF THE INTERIOR

TRANSMITTING

REPORT ON THE DEVELOPMENT OF THE UNUSED LANDS OF THE COUNTRY

OCTOBER 10, 1919.—Referred to the Committee on the Public Lands and ordered to be printed *without* illustrations

WASHINGTON
GOVERNMENT PRINTING OFFICE
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LETTER OF TRANSMITTAL.

INTERIOR DEPARTMENT,
Washington, October 6, 1919.

DEAR MR. SPEAKER: Herewith I transmit a report upon the development of the unused lands of the country made under authority of the last Congress.

This report in much detail gives the possible projects which are available in the various States. The field has not been fully covered because the appropriaton made was not sufficent to go further. We have, however, gone far enough to demonstrate that in most of the States, North, South, and West, there are great bodies of unnsed lands which with drainage or clearing can be made available at a comparatively small cost for farms.

This work has been carried on in the prospect that the Congress would see fit to give to our returned soldiers and sailors an opportunity to go upon these lands under proper guidance and convert them into home farms for themselves. There are one or more bills pending before Congress having this end in view. It is a work that must in my opinion be undertaken soon if we are to maintain our position as a self-supporting people. And surely no other group deserve this opportunity more than the soldiers in the late war. I would not urge this as an exclusive method of stimulating and recognizing the ambition of our soldiers, but I believe it to be one method that carries good and no harm to the country and to the men themselves.

If the objection is raised that the Federal finances will not support the drain proposed, I beg to advise that I am authoritatively informed that there will be no difficulty in selling $500,000,000 in Government 3¾ per cent nontaxable bonds which would be sufficient to cover the expenditures contemplated under the Smoot-Mondell bill. This would be in the nature of a reimbursable fund, the whole being repaid over a long period by the farm owners.

Cordially yours,

FRANKLIN K. LANE.

HON. FREDERICK H. GILLETT,
Speaker of the House of Representatives.

PART I.

INVESTIGATION OF SWAMP AND CUT-OVER LANDS.

INVESTIGATION OF SWAMP AND CUT-OVER LANDS.

In the appropriation for the United States Reclamation Service for the fiscal year 1919 the Congress made the following provision for the investigation of swamp and cut-over lands:

> For an investigation to be made by the Director of the Reclamation Service of the reclamation by drainage of lands outside existing reclamation projects and of the reclamation and preparation for cultivation of cut-over timber lands in any of the States of the United States, including personal services in the District of Columbia and elsewhere, purchase, maintenance, repair, hire, and operation of motor-propelled or horse-drawn passenger vehicles, and for all other expenses, there is appropriated, out of any money in the Treasury not otherwise appropriated, $100,000.

The investigation in the Eastern States north of the Ohio River and of cut-over lands of the Northwest was placed in charge of Mr. F. W. Hanna, and the region commonly known as the Southern States in charge of Mr. H. T. Cory. Both of these gentlemen are engineers of long experience in similar work, with also considerable training in the theory and practice of agriculture. The detailed results of their investigations are given in their respective reports following. Investigations of irrigation and drainage in the Western States was conducted by Mr. F. E. Weymouth.

Any classification of the swamp and cut-over lands of the country must be exceedingly rough and general, as, owing to the nature of the case, two different authorities, however careful and skillful, will probably differ widely in results if these are independently obtained. This is due to the difficulty of setting any definite bounds to any class which may be adopted, owing to the following reasons:

Lands needing drainage can not be absolutely delimited owing to the varying necessities of drainage at different times of year and in different years owing to change of season and mutations of climate. The area is also constantly changing by improvement of natural outlets or the construction of artificial drains, and where the ground water stands too high for one character of production it may be suitable for another. Where the ground water is too high for successful agriculture in a wet year it may in a dry year for the same reason be superior to other lands in the vicinity with low water table.

Many areas of cut-over lands also require drainage, and to be made agricultural must be not only drained but cleared of brush and stumps. Large areas of cut-over lands are too rough or too rocky for agriculture and should be allowed to reforest themselves; but opinions will differ on this point, and any useful classification must take these facts into consideration.

Cut-over lands are even more difficult to define than those needing drainage. The majority of existing forests have at some time or other been cut over, and often the land has been actually in cultivation and practically denuded of trees. The abandonment of fields or the

neglect of the cut-over areas permits the growth of young timber, which is sometimes useful and sometimes of little value. Thus, by one definition, any land that has ever been timbered and cleared may be regarded as cut-over land, although in a high state of cultivation. This is obviously not the usual or accepted meaning of the term. If the fields have been abandoned and young brush has started up, it may in some cases be reduced to cultivation again at moderate expense any time in the first few years, but this expense may increase as the timber grows and clearing becomes more expensive. After the lapse of 50 or 60 years the timber may become merchantable and the land, although strictly speaking has been "cut over" and requires extensive clearing to reduce it do cultivation, may be similar in its essential characteristics to the virgin forest.

Where the merchantable timber has been cut, leaving stumps, young brush, and small trees, it constitutes a typical case of what is known as cut-over land, but as time passes the young trees grow to merchantable size, the stumps gradually decay, and in time we have this land cease to be "cut-over" land.

It is thus obvious that different authorities, however careful or skillful, may differ widely in their reports of the actual areas of wet and cut-over lands and still more widely when attempt is made to classify these as agricultural and nonagricultural. For this reason, any statistics on this subject must be regarded with allowance, and should have the term used carefully defined for specific tables.

The distribution of reclaimable agricultural land is shown by the general map to be very irregular and erratic. The Lake States, the southern Atlantic and the Gulf States contain vast areas of lands requiring drainage and also timber lands, the majority of which have been at some time or other cut-over and a large proportion of which will be suitable for agriculture if properly cleared. It by no means follows that all of such lands should be now or eventually devoted to agriculture.

In many places the swamps and overflow lands serve useful purposes as reservoir sites to diminish the volume and intensity of the floods of the drainage basins in which they occur, and each one should be carefully considered as to the advisability of continuing its services and improving its efficiency for these functions. The regulation of streams is important from many points of view. If our streams could be made to flow with comparative regularity instead of in great flood waves it would terminate destructive floods that cause such havoc and loss of life. To accomplish this we must carry out gigantic projects such as those in the Miami conservancy district in Ohio, designed mainly or exclusively to moderate the freshets and regulate the flow of the streams.

The feasibility of such works depends largely upon the existence of suitable reservoir sites.

A good reservoir site is in several respects a topographic rarity. It must ordinarily have a suitably located basin with a sufficient watershed above which can be closed and formed into a reservoir by a feasible dam of moderate cost which will form a reservoir of large capacity in order that its usefulness may be commensurate with its cost. Where such favorable reservoir sites exist they may be of great value and may constitute the key to the feasibility of river regulation.

and if reclaimed for agriculture and built up with towns, villages, railroads and other improvements, their cost soon becomes prohibitive and the only feasible opportunity of river regulation may thus be destroyed. Every scheme for the drainage and reclamation of swamps and low-lying river bottoms should therefore be carefully considered in its relation to the country at large and especially that below, on the streams to which its waters are tributary, and if the proposed reclamation will in fact destroy a good and useful reservoir site it should not only be avoided but precautions should be taken to prevent the accumulation of improvements which will become obstructions to its utilization for storage purposes. This principle is far more important than usually realized, because we are apt to overlook the need, the rarity, and the essential characteristics of feasible reservoir sites.

Similar precautions are necessary in examining areas of timber or cut-over lands with reference to the wisdom of clearing and devoting them to agriculture. Some lands are so hilly and rocky as to be unsuited to agriculture, although they may be fairly well adapted to forest growth, and these obviously should be devoted to that purpose, but though this seems obvious when stated, it should be remembered that the principle has been often and extensively violated. A considerable part of the alleged "abandoned" farm lands in the New England States are lands that should never have been cleared, as they are more suitable for forest growth than for agriculture, and their abandonment has been simply the recognition of their appropriate use.

The existence of rocks and hills is not by any means the only bar to the suitability of such lands for agriculture. The soil may in some cases be unsuitable for various reasons without expensive modification or application of expensive additions.

Even where the soil and topography are highly suitable for agriculture it by no means follows that it would be wise to clear the cut-over lands and devote them to that purpose. There may be other areas in the vicinity just as favorably conditioned where the cost of reclamation would be less or where the timber that must be removed is less valuable, and different tracts should hence be considered in the light of their suitability for agriculture in location, topography, soil, and climate, and also the character of growth which clearing would remove in order that the most valuable timber stands may be allowed to mature.

We should never forget that we will always need forests and wood lots to complete the prosperous community, and it is just as important to consider and provide for this need in the most efficient and economical manner as it is to provide for any other community needs. In view of the above, it is obvious that only a small fraction of the forested areas which are seen on the general map could be wisely reduced to cultivation at the present time, or even within the next generation. By a wise and skillful discrimination we must select those areas requiring the least expenditure and least destruction to reduce them to cultivation, and must leave uninjured and adequately protected the areas needed for water storage and those most suitable for forest production. This still leaves an ample choice in the States mentioned for all of the reclamation that is likely to

be carried out within the next generation, although the rules upon which selection is made must obviously be modified from time to time.

RECLAMATION OF NEGLECTED FARMS.

In some of the States where little or no opportunity exists for the reclamation of arid, wet, or cut-over lands, there are still abundant opportunities for development which involves reclamation of other kinds. Many areas exist which have been cultivated and for lack of proper treatment have become so nearly barren as to be considered exhausted and unprofitable for agriculture, and are wholly or partly abandoned. Some of these have improved by the interval of non-cultivation, but the major portion require the addition of some of the elements of plant food or the elimination of deleterious qualities by proper treatment.

The majority of eastern soils, for example, are more or less acid and require the application of lime or other antidotes to neutralize the acidity. They generally require also the addition of nitrogen, which can be accomplished by the proper growth of legumes to be incorporated with the soil by plowing under. Some also require the addition of phosphates or of potash, and the cases are numerous where such reclamation as that described is as appropriate and as profitable as reclamation of other kinds in other regions. In same cases large areas have been gradually concentrated in single ownerships, and the system of tenantry which has followed does not produce the best results but leads to the neglect and deterioration of the soil until its cultivation yields little profit. Where such areas can be acquired and cut up into homes they may be restored by proper tillage methods and the addition of nitrogen or other plant food until they are capable of constituting thickly settled and prosperous colonies. It is often found that large ownerships and tenant farming are the accompaniments if not the causes of neglect and partial or entire abandonment of agriculture. Reclamation from such conditions is as wise and as necessary as any other mode of development.

The purpose of the appropriation for these investigations was understood to be the feasibility of preparing farms for settlement by returned soldiers under a planned rural development such as has been carried out in Australia, and many European countries with benefit both to the settler and the community at large. Investigations have shown that many of the so-called abandoned or neglected farms in the Eastern and Middle States can be rehabilitated by proper culture with more or less clearing, draining, and leveling and the addition of lime or other needed constituents of soil.

The investigations along this line were necessarily of a most preliminary nature as one of the principal facts to be developed is the price of land, and no actual negotiations could be carried on to ascertain this in the absence of authority and funds for the purchase. The information therefore is of a general nature but indicates that such opportunities of an attractive character can be found in practically all the Northern, Eastern, and Middle States where improved farms can often be purchased at but little increase over the present value of improvements, and by some or all of the methods

of reclamation above mentioned can be made suitable for colonization at reasonable price.

Those same States also contain many large areas in private ownership, but held at very moderate prices, which belong in the category of wet and cut-over lands requiring drainage in some cases and clearing in nearly all cases. In some instances they have been under cultivation in the past, but have been abandoned for many years or used for pasture only, and allowed to grow up in brush, which will require clearing. Most of such lands also require the addition of lime, the building of roads, and the opening of drainage outlets to permit the escape of excessive rainfall.

NORTHERN DIVISION.

The northern division comprises the area east of the Missouri River and north of the Ohio. The opportunities for soldier settlement are abundant in most of these States, and especially so in the lake States—Michigan, Wisconsin, and Minnesota—where vast areas of cut-over lands and lands needing drainage are found, and some of them were examined in detail.

In several of the States of the Mississippi Valley where agricultural conditions are excellent the development has been so complete that only small areas of undeveloped lands have been found. Some of these are cut-over regions, some are naturally wet places needing drainage, and some are overflow lands which require levee protection and drainage works. These States, however, all contain considerable areas in large ownerships, farmed by tenants, where results are unsatisfactory and are growing worse. Many of these offer favorable opportunities for soldier settlements which will be nearly as beneficial to the country at large and as favorable for the soldier settlements as the reclaimed lands in other States. With proper local cooperation there is no doubt that favorable colonies can be established in all the States.

In New York and Pennsylvania are considerable areas of good cut-over lands, some of which are adaptable to agriculture and very favorably situated for settlements. The convenience of transportation and the abundance of good markets near at hand give these regions important advantages over some others, and in New York are many areas requiring drainage which apparently will afford favorable locations for colonies.

New England presents the extreme case of local need for agriculture. The present agricultural production of New England is but a fraction of what it was half a century ago, while the growth of population and of manufacturing industries makes a market which draws more and more for subsistence upon the Mississippi Valley and the Far West. The development of agriculture here is of first importance in sustaining the manufacturing industries in the face of the necessity of transporting their food and raw materials. Many excellent opportunities for the development of cut-over lands, the drainage of wet lands, and especially the rehabilitation, fertilization, and building up of areas which have in the past been farmed but are now wholly or partially neglected.

The decline of New England agriculture has been due in general to the demand of its growing manufactures for the necessary labor

and the competition of cheap, fertile, and extensive agricultural areas of the Mississippi Valley and the great West. These lands are no longer cheap, and the growth of the Middle West is to a large extent absorbing the product of the western farms so that New England must enter into active competition for its food supply under the handicap of costly transportation. This condition has reversed the influence which led to the decline of New England agriculture, and in providing for its rehabilitation the soldier settlement program affords the opportunity of doing this and at the same time keeping at home the thousands of soldiers who enlisted from these centers of population.

A description of conditions in the various parts of the northern division is to be found in the accompanying report of Mr. F. W. Hanna, who conducted the investigations.

SOUTHERN DIVISION.

In the Southern States opportunities for colonization are of the same three classes. The largest areas are of cut-over lands. In past years small holdings of timber land have been acquired by lumber companies and merchantable timber has been cut and marketed as lumber. Many of these large companies are now operating and are anxious to sell the cut-over land usually at low prices. In some cases drainage would be required and in others drainage should be assisted by opening and straightening surface outlets to permit the ready escape of excessive rainfall. In some of the richest localities where land can be had very cheaply, one of the principal drawbacks which must be overcome is the elimination of the swarms of mosquitoes, which will require careful surface drainage and elimination of stagnant water. Also the clearing of luxuriant vegetation which springs up after the timber is removed. Such areas can only be successfully colonized in tracts of considerable size as it is impracticable to carry out mosquito extermination on a small scale. In many of the Southern States, especially the border States, are to be found extensive areas which have been either abandoned or neglected since the Civil War and are of similar character to those described in New England. They can generally be purchased cheaply and rendered fertile by clearing and the addition of lime and nitrates. Fuller treatment of conditions in individual States will be found in the report of Mr. Cory.

WESTERN DIVISION.

Investigations in the Western States have been carried on under Mr. F. E. Weymouth, chief of construction, who previously had charge of such work in the 17 Western States under the provisions of the reclamation laws. The eastern tier of these States—the Dakotas, Nebraska, Kansas, Oklahoma and Texas—have considerable areas of humid land in which drainage is frequently needed and irrigation is not needed. Lands can be found in all of these States which are not swampy but which a high water table requires that they be drained in order to fit them for other use than pasture or meadow or forest culture. Drainage can in many cases be provided at reasonable cost and where clearing is necessary this also is com-

paratively inexpensive. Farther west irrigation projects have been investigated in the past and numerous opportunities of feasible development of this character exist in most of the Western States.

Such reclamation can be applied to public land in Wyoming, Idaho, Washington, Oregon, California, and Arizona. In the other arid States most of the land to be reclaimed is in private ownership.

The areas west of the hundredth meridian present many opportunities for reclamation, not only by irrigation, but by drainage and by the clearing of cut-over lands, the latter opportunities occurring chiefly in Montana, Idaho, Washington, Oregon, and California. Only a small percentage of these lands, however, are really suitable for reclamation at the present time. East of the mountain ranges the cut-over lands are mainly arid or semiarid and hence require irrigation for successful agriculture. The combination of the cost of irrigation and of the necessary clearing and leveling of the lands is usually prohibitive even in the cases where irrigation is feasible at all, and in such cases it is usually best to encourage the reforestation of the lands by protecting the young growth from fire. Considerable areas of semiarid land may by scientific methods be successfully cultivated without irrigation, but as the results are more or less precarious the values for such agricultural use are usually not high and may exceed the cost of clearing.

There are cases, however, where such reclamation may be wisely carried out. In the extreme Northwest on the Pacific slope are large areas of cut-over lands where deep and excellent soil occurs, where the topography is suitable, and where the rainfall is also sufficient for successful farming. Some areas in this region can be profitably and wisely devoted to agriculture, but in a large portion the cost of clearing, owing to the number, size, and character of the stumps that are in the way, would at present values of agricultural land make the enterprise prohibitive, and the land can best be utilized by reforestation. This is true also to some extent in western Oregon and northwestern California. A large portion of the cut-over lands in the Northwest is, of course, unsuitable for agriculture on account of topography and rocky soil and can best be restored to forest condition.

The great bulk of the land west of the one-hundredth meridian which is not too high, cold, or rocky for agriculture is arid. Of this arid portion over 15,000,000 acres have been placed under irrigation by private or public enterprise, and in carrying out this work of course the more favorable opportunities for such irrigation have been developed. It will still be possible to add many million acres to the irrigated area and perhaps to double the area now irrigated, but this must generally be done at high cost, as the cheap opportunities have been long since exhausted. There are remaining, however, many areas which can be irrigated within feasible costs and will develop values far in excess of the necessary expenditures. They will furnish healthful homes for settlers and will supply agricultural products and food resources in proximity to great mining and grazing resources which will be made more valuable thereby. There is much room for wise and profitable activity in this line in most of the Western States, but the total areas that can be thus reclaimed are much less than those offering opportunities in the States farther east.

The following projects have been investigated and appear to be feasible:

ARIZONA.

Yuma Mesa project.—As an extension to the Yuma project it is proposed to pump water from the main canal of the Yuma project by three pumping plants, raising the water from 40 feet to 80 feet. The plants are to be operated by power generated at two power plants to be located on the main canal. The irrigated area is estimated at 45,000 acres, but the actual development will probably be somewhat less. It is at elevation from 140 to 215 feet above sea level and has a semitropical climate with very seldom any injurious frost. The growing season is 365 days and the average rainfall is less than 3 inches per annum. The freedom from frost and character of soil fit this tract especially for the growth of citrus fruits and other semitropical products. There has been some demonstration of citrus culture on adjoining lands, which shows its adaptability to this product. Irrigated lands in the vicinity are valued at from $250 to $300 per acre. The major portion of this tract is public land.

Parker project.—On the Colorado River Indian Reservation at and below the town of Parker on the Santa Fe Railroad is a tract of land approximating 200,000 acres, a large part of which can be irrigated by diverting the waters of the Colorado River upon it. A small part of this land is already irrigated by pumping from the Colorado River. The climate is similar to that in Salt River Valley and Imperial Valley and is adapted to the growth of cotton and semitropical products generally. As the present works on the river below utilize the unregulated flow of the Colorado River at low water, the development of this project will require storage works, which will be discussed under a separate heading. This project has not been examined in detail, but enough is known to justify the opinion that it is feasible.

CALIFORNIA.

The Imperial Valley, in southeastern California, lying mostly below sea level, is a general tract of very fine alluvial land with semitropical climate, which is watered from the Colorado River diverted just above the Mexican line and carried in narrow channels for a distance of 60 miles through Mexico and back into California, where it is used for irrigation. This water is subject to adverse diversion in Mexico, and to avoid the progressive depletion of the supply from this cause, it has been proposed to build a high-line canal by diverting water from Laguna Dam, above the Yuma project, and carrying it on a high-line grade entirely in California to the Imperial Valley. This will be high enough to reach about 400,000 acres of land that can not be covered from present works and would also carry water for the land now irrigated. It would enable the irrigated area in California to be more than doubled. As the area irrigated at present from the Colorado River consumes all the natural flow at low-water season in some years, it is not regarded as feasible to add materially to the cultivated area without providing

storage on the Colorado River. This storage may be accomplished at reservoirs on the Colorado River and tributaries, which have been investigated and are listed in a subsequent table.

The high-line canal proposed will afford opportunity for the development of considerable hydroelectric power, which can be used for pumping to additional lands above the gravity canals and can also be used for various purposes of the settled region of the irrigation project. The irrigation works contemplated for this development will probably cost about $52,000,000.

In addition to the development described, the works will incidentally obviate the necessity of building a temporary dam every year in the Colorado River at the present heading. This dam is regarded as a menace to the safety of the Yuma Valley, and its construction is accompanied by a bond of $600,000 to indemnify the owners for any losses that might occur from this construction. The major portion of the lands to be irrigated, in addition to those now irrigated, are public lands.

Orland project.—The Orland project of the Reclamation Service now covers about 20,000 acres which receive water from the East Park storage reservoir on Stony Creek. It is proposed to build another reservoir on Stony Gorge on the main stream and add 30,000 acres to the present project. Both of these units may be considered portions of the general development of the Sacramento Valley, but stand in an independent position financially. The probable cost of this development would be $2,500,000. The climate of the proposed project is similar to the rest of the Sacramento Valley and furnishes a growing season throughout most of the year, with an average rainfall of about 18 inches, nearly all of which falls in the winter months. The preliminary investigation of this project has been completed, and construction can begin without delay if funds are provided.

Iron Canyon project.—The largest unit of the general Sacramento Valley development is provided with a water supply by the construction of a large storage reservoir at Iron Canyon above the town of Red Bluff. The land to be irrigated is mostly private land and comprises about 250,000 acres. It has an average rainfall of about 17 inches, nearly all of which falls in the winter, and a growing season of seven to eight months. It is adapted to the growth of alfalfa, rice, fruits, and vegetables. The low water flow of the Sacramento river is already utilized for irrigation, and no large additional developments are possible without storage. The Iron Canyon site furnishes the only feasible site in which the Sacramento River waters can be stored and will furnish a supply for about 250,000 acres of land. The probable cost of the works proposed will be about $35,000,000, and this will include a large power development which will assist largely in paying interest on the investment. The value of developed land in this valley ranges from $150 to $250 per acre.

Turlock-Modesto district.—In Stanislaus, Merced, and Tuolumne Counties, Calif., are about 260,000 acres of land, most of which are now covered by canals, but which require an additional water supply through storage which it is proposed to provide in Don Pedro Reservoir on the Tuolumne River. This reservoir will have a ca-

pacity of about 260,000 acre-feet and will cost about $5,000,000. All of the land is in private ownership and most of it is as fully developed as practicable without additional storage facilities. The growing season is about 300 days and the average rainfall about 12 inches per annum, mostly in winter.

King's River project.—In Fresno, Tulare, and Kings Counties, Calif., is an area of about 400,000 acres, with an average rainfall of about 10 inches, mostly during the winter months, and a growing season of 9 or 10 months. The lands are practically all in private ownership and most of them are irrigated from the unregulated flow of Kings River and its tributaries, but the supply is inadequate in the latter part of the season, and it is proposed to construct a storage reservoir on Kings River with a capacity of about 600,000 acre-feet which will make possible the development of a large amount of power for use in lowering the water plane in the waterlogged areas. The pumped water can be used for irrigation upon adjacent lands. The irrigation works proposed will probably cost about $12,000,000 and the values to be created are ample to make its return secure.

Blythe project.—On the west side of the Colorado River below the Parker project is a tract of 40,000 acres of good land averaging about 250 feet above sea level, most of which can be watered from the gravity flow of the Colorado River if proper diversion is provided. A large amount of this land is already irrigated, but the works are inadequate and river protection is required. Its proper development will also require the construction of storage works from the Colorado River above. The works proposed will probably cost about $5,000,000, and will include a share in the storage costs. The climate is semi-tropical, with an average rainfall of about 3 inches per annum. The climate and soil are adapted to the growth of alfalfa, cotton, sugar beets, melons, fruits, and vegetables.

Colorado River Basin.—The natural flow of the Colorado River during the low water season is practically all required for irrigation of lands now under cultivation in Imperial Valley on the Yuma project and at other points along the river. Further development of consequence must therefore provide storage, a number of excellent sites for which have been examined on the Colorado River itself and upon various tributaries. In addition to the needs of irrigation, the lower valleys have important problems of protection from the overflow of the Colorado River and this problem can be greatly ameliorated by proper storage works within the basin. If a reservoir were built on the lower Gila and one on the lower Colorado where it forms the boundary between Nevada and Arizona, these two reservoirs, if of sufficient capacity, would control waters so as to regulate all the menacing floods. The latter would at the same time regulate the water for irrigation and afford an important auxiliary product in the shape of valuable water power. Preliminary investigations have been made of the Sentinel Reservoir site on the lower Gila and of the Boulder Canyon reservoir site on the Colorado River a short distance below the mouth of the Virgin River. While these investigations are not yet complete, indications are that feasible storage for the above purposes can be found at these points.

Other feasible sites have been found at the locations given in the following table:

Principal reservoir sites in Colorado River Basin.

Reservoir.	Location.		Height of dam, feet.	Estimated capacity, acre-feet.	Foundations.
	State.	River.			
Ouray	Utah	Green	170	10,000,000	Rock at from 27 to 128 feet.
Junction	do	Colorado	200	4,500,000	Borings from 100 to 376 feet did not reach bedrock.
Flaming Gorge	Utah and Wyoming.	Green	215	3,120,000	Bedrock at 73 feet.
Dewey	Utah	Grand	215	2,270,000	Bedrock at from 30 to 45 feet.
Sentinel	Arizona	Gila	130	2,220,000	Borings to 220 feet did not reach bedrock.
Kremmling	Colorado	Grand	230	2,200,000	Bedrock at from 80 to 96 feet.
Browns Park	Utah and Colorado.	Green	180	2,060,000	Bedrock at from 109 to 139 feet.
Juniper	Colorado	Yampa	200	1,550,000	Bedrock at 24 feet.
Bluff	Utah	San Juan	206	1,350,000	Not tested.
Hogback	New Mexico	do	207	1,200,000	Do.

COLORADO.

Grand Valley project.—The Grand Valley project of the Reclamation Service is at present not complete. The gravity system has been completed for 35,000 acres of land, laterals being required for the remaining 5,000 acres. Pumping units may be built for serving 10,000 acres more. The area of this project is about 50,000 acres. It lies at altitudes ranging from 4,750 to 4,900 feet above sea level and has an average rainfall of about 8 inches per annum. The climate and soil are adapted to the growth of alfalfa, sugar beets, potatoes, small grains, fruit, and vegetables. The natural flow of the Grand River is ample for all needs of this project in addition to the power appropriations. The cost of the proposed irrigation works for completing this project is estimated at $600,000. The uncultivated area is about one-half private land and about one-half public land. Investigations have been completed and construction can be begun whenever funds are available.

Orchard Mesa project.—In Mesa County, Colo., upon Orchard Mesa south of Grand River there is a tract of about 9,700 acres of land for which irrigation works have been built by private enterprise. The works are insecurely located and a large portion of them, being built of wood, are in an advanced stage of decay. It is necessary to build a new system at a cost of about $800,000 and the financial feasibility depends upon making suitable arrangements for the cancellation of present liabilities of the district and the security of the return of additional investments. The most feasible method of reconstruction is by utilizing the upper part of the present high line Grand Valley canal built by the Reclamation Service and diverting water from that canal just above the long tunnel before it reaches the valley. This can be carried through a siphon across Grand River and conducted in a canal to the pumping plant of the Orchard Mesa district, where the present works can be utilized to

pump the water to the necessary elevation. Preliminary investigations of this project have been completed and construction can be taken up as soon as the district is able to enter into satisfactory contract and funds become available.

Grand Valley drainage project.—The original Grand Valley canal, irrigating land in the vicinity of Palisade and Grand Junction, was built by private enterprise and serves the lower lands of the Grand Valley with an abundant supply of water. Its use has progressively increased the elevation of ground water until at the present time a large acreage has been rendered infertile, and this area is rapidly spreading. A comprehensive drainage system is badly needed. With necessary authority and funds provision could be made for the construction of 52 miles of open drains and 162 miles of closed drains, emptying into natural drainage channels. This construction would cost about $1,200,000. There would be about 30,000 acres of land directly benefited, a large portion of which is improved and has a value far above the cost of the proposed works. The land lies at an elevation of 4,500 to 4,800 feet above sea level and has an average rainfall of about 8 inches per annum. The growing season is long. The climate and soil are adapted to alfalfa, sugar beets, potatoes, small grains, and fruit. The Denver & Rio Grande Railroad traverses the tract.

Montezuma project.—In Montezuma County, Colo., is an area of about 50,000 acres of irrigable land, most of which are embraced in the irrigation district which was formed in 1902. Works were built to irrigate a portion of this land but the water supply is inadequate and the works are in poor condition and constantly deteriorating. About half of the land is now irrigated with poor results. There is usually a shortage of water after July 15. A preliminary survey has been made, but the feasibility of the Government rehabilitation of this project depends largely on the attitude of the landowners and the creditors of the Montezuma irrigation district. There are about 8,000 acres of State land in the project, the remainder being in private ownership. The proposed plan contemplates the construction of storage reservoirs on the West Dolores River and the reconstruction of the irrigation system now operated by the Montezuma irrigation district. The estimated cost of improvement is $3,500,000. The natural rainfall averages about 12 inches per annum. The soil and climate are well adapted to the usual temperate zone products, including fruits.

San Luis Valley drainage project.—In San Luis Valley in Colorado about 400,000 acres of land have been waterlogged, owing to excessive application of irrigation water, the uncontrolled flow of artesian wells, and the very slight declivity of the ground. Drainage districts under private enterprise have already been constructed for the relief of 50,000 to 60,000 acres. Extensive preliminary studies have been made of this project and definite plans for construction can be made in a short time. Before work can be commenced it will be necessary to enter into suitable arrangements with the landowners providing for repayment of the cost of the proposed works. It is proposed to lower the present water table by means of deep drainage ditches and construct a deep outlet drain through the trough of the valley discharging into the Rio Grande. The mean annual rainfall for this region is

7.27 inches with a minimum of less than 4 inches. The lands lie at an average elevation of about 7,600 feet and the length of the irrigation season is about five months. Hay, sugar beets, field peas, and potatoes are the staple products. The construction works will probably cost about $10,000,000. The values created would afford ample security for repayment.

IDAHO.

Hill Crest extension, Boise project.—The area embraced within this project is covered by two irrigation districts organized under the laws of the State of Idaho. The lands lie above and adjacent to the main canal of the Boise project. It is proposed to utilize the existing hydroelectric power of the plant at Boise River diversion dam to operate the pumping plant to lift the water 80 feet to the main canal to serve these lands. This canal will have a capacity of 200 cubic feet per second, besides lateral systems for distribution to the various farms. The average annual rainfall of this region is a little under 13 inches. The lands lie about 2,800 feet above sea level and from 5 to 10 miles from the city of Boise. They are well adapted to alfalfa, corn, small grain, and fruit. The proposed works will probably cost about $700,000 and the values to be created would afford abundant security for its repayment.

Black Canyon unit, Boise project.—On the north side of Boise River lying above existing canals is a tract of about 39,000 acres which can be irrigated by a canal system heading near the city of Boise, which could be served from the Arrowrock reservoir. This area is embraced in the Black Canyon irrigation district organized under the laws of Idaho. It is proposed to construct a diversion weir and headworks on the Boise River, and to build a canal some 50 miles in length having a capacity at the head of about 1,000 cubic feet per second. The tentative estimate of the proposed work is about $2,000,000. The land is practically all unimproved, but has mostly passed into private ownership. There are remaining about 3,000 acres of public land and 1,000 acres of State land. The elevation of these lands will average about 2,400 feet above sea level, and the average rainfall is about 12 inches per annum.

Minidoka project, north side extension.—On the north side of the Snake River adjacent to the Oregon Short Line Railroad and the town of Minidoka there is a tract of about 102,000 acres of irrigable land lying above the main canal of the Minidoka project. None of this land is under cultivation, and nearly all is public land. The plan under consideration proposes the pumping of water from Lake Walcott to a maximum limit of 120 feet and distribution by gravity to the lands to be cultivated. Power for pumping purposes can be developed at Eagle Rock and American Falls power site. The average annual rainfall is below 13 inches and the elevation averages about 4,300 feet above sea level. The whole tract lies adjacent to the Oregon Short Line Railway and its branches. The proposed irrigation and storage works would cost about $15,000,000.

Hansen Butte project.—An area of about 22,000 acres in Twin Falls County, Idaho, lies adjacent to and above the south side Twin Falls canal. This land is mostly held in 160-acre tracts of homestead entries, and much of it has been patented. By the construction of

additional storage on Snake River the land might be irrigated by pumping from the backwater above the Milner dam. Power might be developed at the present Minidoka power plant at Eagle Rock and American Falls. The lifts will range from 60 to 100 feet, and about 7,000 horsepower will be required for pumping purposes. The proposed works would probably cost about $2,000,000.

Gem project.—This project is included in the Gem irrigation district, organized under the laws of Idaho, which now operates a pumping plant and canal system. Power is purchased from private companies under conditions unsatisfactory to the landowners. The district has an indebtedness of about $800,000, and is unable to pay its operating expenses under fixed charges. It is proposed to construct a power plant at Arrowrock with a transmission line about 50 miles long to the present pumping plant of the Gem irrigation district, which would be enlarged, and the present canal and lateral systems of the district will need to be enlarged and improved. The area to be served is about 27,000 acres, of which a portion is being cultivated at present. The average elevation is about 2,350 feet above sea level, and the average rainfall about 12 inches per annum. The growing season is from 6 to 7 months and the staple products are alfalfa, small grains, vegetables, and fruits. The proposed works are estimated to cost about $750,000.

Lake Walcott project.—In Cassia County, Idaho, there is an area of 2,500 acres along the southern margin of Lake Walcott which could feasibly be irrigated by pumping from that lake with electric power developed either at the present Minidoka pumping plant or at American Falls. The land lies about 4,400 feet above sea level and has an average rainfall of 12.74 inches per annum. It is nearly all unentered public land. The estimated cost of contemplated construction is $215,000.

Snake River storage, American Falls Reservoir.—At the town of American Falls on the Oregon Short Line Railway the Snake River flows through a narrow valley which might be closed by the construction of a suitable dam and would afford a storage capacity from 2,000,000 to 3,000,000 acre-feet, as desired. This site is already used for the development of power and certain rights have accrued to the use of water for this purpose. It is proposed to build the reservoir and to permit the use of about 1,000 second-feet of continuous flow from the reservoir for power purposes at all points below, and to apply the remainder for irrigation purposes. This would require a reservoir capacity of 2,300,000 acre-feet and would supply irrigation water for about 450,000 acres of land. New lands could be served to a very good extent and the acreages of old land already using the waters of Snake River below this point are nearly sufficient to consume the storage water. The provision of this reservoir could be made to serve these lands and thus release the demand upon the Jackson Lake Reservoir which is greatly needed by lands above American Falls. The development of the American Falls Reservoir site would make available the entire flow of Snake River for irrigation and power purposes. It would flood about 66,000 acres, including a part of the town of American Falls. It is an important consideration in any complete development in the Snake River basin. The cost of this work is estimated at about $12,000,000, which is dis-

tributed to and included in the estimates of cost of the various tracts which would be irrigated therefrom.

Island Park reservoir.—By the construction of a dam at Island Park on the upper North Fork of Snake River, 565,000 acre-feet of storage would be afforded by a dam 90 feet in height. The construction of this reservoir is only contemplated in case the American Falls Reservoir is not constructed. Tentative estimate of the cost is $4,000,000. About 15,700 acres would be flooded, of which about 5,000 acres are in private ownership and the balance in the Targhee National Forest.

Boise Valley drainage basin.—On the north side of the Boise River there is a tract of about 30,000 acres which has been injured by the rise of the water table and is now used mainly for pasture. To restore its fertility it requires a comprehensive drainage system, involving about 45 miles of open drains from 6 to 10 feet in depth. This is estimated to cost $600,000. All of the lands are in private ownership and an irrigation district has been formed under the laws of Idaho. The proposed drainage system would cost about $600,000. In case of provision of authority and funds for this work, it would make a feasible and attractive project.

Payette Valley drainage project.—In Canyon County, Idaho, in the valley of the Payette River, is about 10,000 acres of land which has been injured by the rise of ground water and requires for its reclamation the construction of about 18 miles of drainage channels from 6 to 12 feet in depth. The proposed system would cost about $180,000. All of the area is in private ownership in tracts from 40 to 160 acres.

MONTANA.

Milk River project, Chinook and Beaver Creek division.—These units are extensions of the Milk River project which would cost about $1,700,000 and would add to the area served by this project about 97,000 acres. Both require storage reservoirs, the Chinook Division getting its increased water supply from storage on the St. Mary River which would be conducted in the St. Mary Canal of Milk River for diversion near Chinook. The Beaver Creek storage would be provided upon that creek just above the lands to be served. The Chinook division is mostly private land and part of it already irrigated with an insufficient water supply. Beaver Creek division is mainly public and State land.

Sun River project, Greenfields Bench division.—About 65,000 acres can be added to the Sun River project by the construction of a storage reservoir on Sun River and the extension or enlargement of the canal systems. The proposed works would cost about $4,000,000. The lands are well adapted to temperate zone products, especially hay, grains, vegetables and sugar beets, and the majority of them are public lands. Some of these lands have been dry farmed but the last three years have been so dry that this has not been a success and it is demonstrated that irrigation is necessary for successful farming in this region. The average rainfall is between 11 and 12 inches per annum, and the elevation is a little above 4,000 feet.

Bitter Root Valley project.—In Ravalli County, Mont., there is an area of about 30,000 acres, a portion of which is already irrigated and which is inadequately supplied with water. The existing works are inadequate and require reconstruction, all structures being badly deteriorated. All of the lands are in private ownership. Only a preliminary investigation has been made of this project, but it would probably cost about $1,500,000 to put it in first-class condition.

NEBRASKA.

North Platte project extensions.—About 130,000 acres can be added to the cultivated area of the North Platte project by the construction of an additional reservoir above Guernsey and the necessary canals. The work contemplated would cost about $9,000,000 and would produce excellent results. The average elevation is about 4,100 feet above sea level and the average rainfall is about 13 inches per annum. The growing season is about six months and the climate and soil are adapted to the growth of alfalfa, cereals, sugar beets, and potatoes. About one-half the land is in private ownership and the balance is public and State land.

Lincoln and Dawson County project.—By the construction of a low diversion weir across the Plate River about 6 miles east of the town of North Platte and diverting water into a canal about 45,000 acres of land on the north side of the Platte River can be irrigated. The reconnoissance indicates that this could be accomplished by the expenditure of $2,500,000. The water supply would be from the stored supply of the North Platte River and the return drainage water from the irrigated lands of the North Platte project.

Farmers' ditch and canal project.—This canal would take water from the opposite end of the diversion dam mentioned above to be located about 6 miles east of North Platte, Nebr. Such a canal would cover about 50,000 acres of land on the south side of Platte River, and the canal system and its share of the diversion is estimated to cost about $2,000,000. All of the land to be benefited is in private ownership and its feasibility depends upon the outcome of negotiations with the landowners. The elevation of these two tracts is about 2,600 feet above sea level and the average rainfall about 22 inches per annum. The growing season is about 200 days and the staple crops are alfalfa, wheat, corn, oats, and potatoes. The Union Pacific Railroad furnishes excellent transportation facilities for this tract.

NEVADA.

Upper Carson project.—In Douglas County, Nev., are 39,000 acres of irrigable land averaging about 4,800 feet above sea level which can be feasibly irrigated from the East and West Forks of the Carson River with storage in Horseshoe Reservoir and others that are available. The average rainfall is about 12 inches per annum and the growing season is about six months. About 17,000 acres of this land are now in cultivation under privately owned canals which do not furnish a full-water supply owing to the shortage in the latter part of the season which must be supplied by storage. Investigation of this project is well advanced and construction can be taken up as

soon as negotiations with the landowners are satisfactorily concluded and funds are available. About 10 per cent of these are public lands and the rest are private lands. The reservoir and other necessary works are estimated to cost about $2,000,000. The principal crops available are alfalfa, small grains, and potatoes, and the locality would be good for a suitable beet-sugar factory. Good transportation facilities are furnished by the Southern Pacific Railway.

Pyramid Lake project.—In Washoe County, Nev., are about 19,000 acres of irrigable land most of which is public land and part of which is allotted Indian lands which can be irrigated by a branch of the main canals of the Newlands project provided adequate storage is furnished. The growing season of this region is about 200 days and the average rainfall about 4 inches per annum. The elevation will average about 4,000 feet above sea level, and the principal crops are alfalfa, grain, and potatoes. None of this land is in cultivation but preliminary surveys have been made and construction may begin as soon as funds are provided and the legal rights as to the waters of Lake Tahoe have been settled. The proposed works will cost about $1,200,000.

NEW MEXICO.

San Juan project.—In northern New Mexico it appears feasible to divert the waters of the San Juan River to the southward for the irrigation of about 125,000 acres of irrigable land lying within and adjacent to the Navajo Indian Reservation, very little of which is under private ownership. The elevation of these lands will average about 5,200 feet above sea level. The average rainfall is about 8 inches per annum and the growing season is about five months. The climate is suitable for temperate-zone crops such as alfalfa, cereals, vegetables, and fruits. The nearest railroad is the Denver & Rio Grande at Farmington, N. Mex., from 6 to 30 miles distant from various parts of the tract. Only a preliminary reconnaissance has been made of this project and this indicates that the necessary storage and distribution works are feasible but no estimate of cost has been made.

Middle Rio Grande drainage project.—In Sandoval, Bernalillo, Valencia, and Socorro Counties, N. Mex., are about 100,000 acres of land in most of which the ground-water table is high and some of which is infertile for this reason. It is proposed to build drainage works for this region and by the provision of irrigation works to irrigate the same land. Preliminary investigations, most of which have been conducted by the State engineer of New Mexico, and which are still in progress, indicate that this tract is feasible and that it would cost between five and six million dollars. The entire tract is traversed longitudinally by the Atchison, Topeka & Santa Fe Railroad. The average rainfall is about 7½ inches per annum and the altitude from 4,500 to 5,200 feet above sea level. The products are those characteristic of the warm temperature zone.

OREGON.

Klamath project pumping units.—On the Klamath project in Oregon investigations have been made showing the feasibility of irrigating about 23,000 acres of land lying above the present canals by some

extensions and enlargements of the said canals, with power developed in the neighborhood of Klamath Falls. The successful cultivation of the Klamath project demonstrates the adaptability of these lands to alfalfa, small grains, and vegetables. Some of the lands have been dry farmed with indifferent success. All are in private ownership but mostly held in tracts of 160 acres or less. Investigations are so far completed that construction can begin as soon as funds are available and arrangements can be made with the land owners.

Klamath project, Langell unit.—In Langell Valley, Oreg., are about 17,000 acres of irrigable land, most of which has been cultivated by dry-farming methods or by flooding from Lost River. This land is in private ownership and the owners have indicated a desire for storage which can be feasibly accomplished by the construction of the Horsefly Reservoir to store the necessary water. The proposed works are estimated to cost about $1,000,000. The growing season is about 5 months, and the climate and soil are adapted to the growth of hay, cereals, and potatoes.

Klamath project, Tule Lake lands.—By the construction of the Tule Lake Reservoir and diversions from Lost River the sulplus water previously finding its way into Tule Lake has been greatly diminished and large areas of rich agricultural lands have been made available as the surface of the lake has receded through evaporation. To supply water for the irrigation of these lands enlargements and extensions of the irrigation works of the Klamath project are contemplated. All of this area is public land. A portion of the lake bed adjoining this area on the north was opened to settlement in 1917 and its cultivation has shown excellent results. Investigations are complete and construction can be commenced whenever funds are available, but will have to proceed gradually on account of the slow lowering of the surface of the waters of Klamath Lake by evaporation and natural seepage. The proposed construction works will cost $1,250,000.

Rogue River project.—In Jackson County, Oreg., it is possible to irrigate about 30,000 acres of land from the Rogue River and tributaries properly supplemented by storage. The land lies at an elevation of from 1,200 to 2,000 feet above sea level with an average rainfall of about 20 inches per annum, mostly in the winter. The growing season is from six to seven months. The climate and soil are adapted to the growth of forage crops and fruits, and good transportation is furnished by the Southern Pacific Railway. Practically all of the land is in private ownership, and much of it is in cultivation. In years of maximum rainfall irrigation is not needed, but in average seasons it will materially increase crop production, and in years of minimum rainfall crops can not be grown without irrigation. Further investigation of this project is needed, and suitable agreement with the landowners will be necessary before construction can be taken up. Present information indicates a construction cost of about $2,000,000.

Greater Umatilla project.—On the Umatilla project in Oregon about 20,000 acres are irrigated by the Reclamation Service, and fine crops of alfalfa, fruits, and vegetables are being produced. There are large adjacent areas of about 39,000 acres which might be added

to this project by extension of the works and the provision of storage works. The altitude of this land is from 300 to 700 feet above sea level with an average rainfall of 8 to 9 inches per annum and a growing season of six to seven months. About one-third of this area is already cultivated and irrigated but does not receive full irrigation supply and consequently can not yield full production. Numerous petitions have been presented to the department for the Government to provide relief for the settlers by the construction of adequate storage facilities. Of the uncultivated area there are about 3,500 acres of public land, 3,000 acres of railroad land, and the balance is private. A suitable storage reservoir has been surveyed on McKay Creek, and preliminary investigations indicate the project as feasible, but further investigations are required. The cost of the necessary works will probably be about $3,100,000.

Owyhee project.—By the construction of a storage reservoir on the Owyhee River and of canals to distribute the stored water, it is feasible to irrigate about 23,000 acres of land in the vicinity of that river. At necessary drops in the canals suitable power plants may be constructed to water about 20 per cent of the land which lies above the canal. The lands lie from 2,150 to 2,350 feet above sea level and the average rainfall is about 10 inches per annum, with a growing season of about six months. The soil and climate are adapted to the growth of alfalfa, grains, potatoes, and fruits. The Oregon Short Line Railway reaches this vicinity and furnishes transportation. About 17,000 acres of the land are in private ownership and the balance public. The construction of this project depends upon the outcome of negotiations with landowners and the appropriation of necessary funds. The works proposed are estimated to cost about $2,100,000.

Deschutes project.—This project is divided into four units—the north side unit contains about 100,000 acres and is to be supplied by a canal from Deschutes River at Aubray Falls. The south side unit comprises 40,000 acres, to be served by a canal diverting from Deschutes River at Lava Falls; the east side unit of 35,000 acres is to be served by a canal known as the north canal, constructed by the Central Oregon Irrigation Co.; and the west side unit served by a canal diverting at the diversion dam for the north side unit at Laidlaw. The necessary works are estimated to cost about $12,000,000. The altitude of these lands is from 2,500 to 4,000 feet and the average rainfall varies from 9 to 10 inches. The growing season will average about 120 days and the climate is adapted to the growth of hay, grain, and potatoes. Transportation is furnished by the Oregon Trunk Railway and the Oregon-Washington Railroad & Navigation Co. A sufficient water supply will require the construction of storage works. The investigation of this project is now in progress.

Lower Powder River project.—It is proposed to irrigate about 50,000 acres of land along Powder River and vicinity, of which 17,700 acres are withdrawn under the Carey Act; and 25,000 is in private ownership. The altitude of this land ranges from 2,700 to 3,500 feet above sea level and it has an average annual rainfall of about 13 inches. The growing season is about 140 days and hay, small grains, vegetables, and fruits can be produced. It is proposed

to build two reservoirs and a series of canals to irrigate these lands and the probable cost will be $7,000,000. Further investigation of this project is required to ascertain its feasibility. These investigations are now in progress.

Horsefly storage project.—It is proposed to store the waters of Miller Creek in Klamath County, Oreg., by the construction of the Horsefly storage reservoir. This would impound about 75,000 acre-feet of water for the irrigation of Langell and Yonna Valleys for use upon reclaimed lands in Tule Lake Basin. It would also assist in the progress of lowering the level of Tule Lake, making it possible to reclaim additional lands from the bed of the lake. Additional investigations of this reservoir are needed but the present information indicates a feasible reservoir to cost about $300,000.

SOUTH DAKOTA.

Belle Fourche project storage.—The Belle Fourche project of the Reclamation Service is successfully irrigating about 80,000 acres of land, which has been supplied with canals and storage water from Owl Creek Reservoir. About 3,700 acres of additional land are also covered by canals, but lie too high for service from the Owl Creek Reservoir and require an additional reservoir for the best results. The private irrigation system managed by the Redwater Irrigation Association is also in need of storage and plans are in contemplation for construction on some equitable basis of the so-called Chicken Creek Reservoir to furnish both tracts with irrigation water during the low stages of the Redwater Creek and the Belle Fourche River. It is also proposed to enlarge and extend a part of the present Belle Fourche project to cover about 15,000 additional acres in the Willow Creek and Nine-Mile Creek regions. The works necessary for these extensions of the Belle Fourche project are estimated to cost about $700,000. The lands to be benefited contain about 11,000 acres of unentered public and State lands.

NEW MEXICO.

Rio Grande project extension.—It is proposed to extend the irrigation works of the Rio Grande project to cover two tracts known as the Tornilla and Fort Hancock tracts, lying below the El Paso Valley. These contain about 27,000 acres of irrigable land at an altitude averaging 3,500 feet above sea level. The growing season is about eight months in length and the rainfall averages about 8 inches per annum. The climate and soil are adapted to the growth of all warm-temperate products, including cotton, corn, and fruits. The Southern Pacific Railway system passes through the valley and furnishes good transportation. Storage is already provided for these lands by the Elephant Butte Reservoir. It will be necessary to build drainage works as well as irrigation canals for the lands described. All of the land is in private ownership and 5,000 acres of it is now farmed by a small diversion of the waste water from the river. The water supply, however, is very unreliable and poor results are obtained. Some of these lands have recently made temporary water rental contracts and are being furnished with a stated supply from the Elephant Butte Reservoir. Further investigations

and suitable agreements with the landowners will be required before these extensions can be constructed. They are estimated to cost $1,200,000.

UTAH.

Castle Peak project.—About 70,000 acres of land lying along the Deschutes River may be irrigated by the construction of canals to divert the natural flow of Strawberry and Deschutes Rivers supplemented by storage. The average elevation of these lands is about 5,200 feet and the growing season 160 days. The average annual rainfall is from 8 to 10 inches per annum, and the climate and soil are adapted to the growth of alfalfa, sugar beets, and small grains if an adequate water supply is furnished. The nearest railroad facilities are 80 miles distant. The entire irrigable area is public land, some of which has been entered, but the claimants have found it impossible to live upon their claims until water is furnished. Further investigations will be required, but present information indicates that the project can be constructed at a cost of about $7,000,000.

Price River project.—The irrigation of a portion of this tract was undertaken several years ago by private companies, which constructed the Mammoth Reservoir on Price River. The reservoir failed and has not been reconstructed. The major portion of the irrigable land is unentered public land. Preliminary surveys have been made of Pleasant Valley Reservoir site and gauging stations established to determine the amount of water available for the development of this project. Further investigations are required, but present information indicates the feasibility of the irrigation of about 30,000 acres of land with water diverted from Price River supplemented by storage on Fish Creek. The average rainfall is about 12 inches per annum, and the climate and soil are adapted to the growth of hay, sugar beets, small grains, and vegetables. The Denver & Rio Grande Railroad passes through this tract.

Dixie project.—In Washington County, Utah, there are about 30,000 acres of irrigable land, which it is proposed to irrigate by diverting the waters of Virgin River, supplemented by storage in the upper part of that watershed. About 20,000 acres of this land are under cultivation, most of which has an insufficient water supply. The elevation of the valley varies from 2,500 to 4,000 feet above sea level. The average rainfall varies from 8 to 9 inches, and the growing season is about 200 days. The valley is adapted to the growth of alfalfa, cotton, vegetables, fruits and nuts, and to all products of the warm Temperate Zone. The most accessible railroad to this tract is about 90 miles distant. Only a reconnoissance examination of this project has been made, and further examination will be necessary to establish its feasibility.

Utah Valley drainage project.—In Utah County there are about 30,000 acres which have been rendered more or less unproductive by a rising water table due to excessive irrigation and the unregulated flow of hundreds of artesian wells. It is proposed to construct drainage works to relieve these lands, but the investigations thereof are not complete. The present indications are that this system will cost about $1,000,000. All of the lands to be benefited are in private

ownership, and extensive surveys will have to be made, drainage districts organized, and contracts entered into before the construction of this project can be taken up. The land averages about 4,500 feet above sea level and has an average rainfall of 18 inches per annum. The growing season is about six months, and the climate and soil are adapted to the growth of hay, cereals, sugar beets, and vegetables.

WASHINGTON.

Yakima project high line.—By the construction of high-line canals from the Yakima River and tributaries in Yakima and Benton Counties, Wash., it is proposed to irrigate about 150,000 acres of land lying above the present canals. This land lies at elevations from 350 to 1,600 feet above sea level and its suitability for the growth of warm, temperate-zone products, including fruits, has been demonstrated. It is proposed to build adjacent storage reservoirs and canals diverting from the Yakima and Naches Rivers and also to enlarge and extend the existing canals to some extent. The probable cost of the proposed works is about $20,000,000. Investigations of this are still in progress. The lands comprise about 13,600 acres of unentered public land, 6,000 acres of State land; and of private, entered public, and railroad, 130,000 acres. The entire region is served with excellent transportation by the Union Pacific, the Northern Pacific, and Milwaukee systems. While the investigations are not complete, the project is undoubtedly feasible if suitable arrangements can be made with the landowners.

Kittitas project.—In Kittitas County, Wash., is an irrigable area of about 70,000 acres at varying altitudes from 1,500 to 2,200 feet above sea level. The average rainfall is about 9½ inches per annum and the growing season about five months. The climate and soil are adapted to the growth of alfalfa, small grains, sugar beets, fruits, and potatoes. Excellent transportation is furnished by the Northern Pacific and the Chicago, Milwaukee & St. Paul Railways. The irrigation plan contemplates the construction of additional storage reservoirs and a main canal diverting from Yakima River near Easton with necessary lateral systems. The proposed works are estimated to cost about $8,500,000. Most of the lands are included in the Kittitas reclamation district, which has been unable to market its securities. The surveys and construction plans are complete, and construction can be taken up promptly upon the provision of funds and a satisfactory contract with the irrigation district. Most of the lands are in private ownership, but about 5,000 acres are public land, 2,500 acres State land, and 9,300 acres railroad land.

Washington storage projects.—The projects above named are without storage, and it is proposed to furnish this by the construction of one reservoir at Lake Clealum and one on the Tieton River. The cost of these reservoirs has been prorated to the projects above described.

WYOMING.

Riverton project.—In Fremont County, Wyo., are situated about 85,000 acres of irrigable land lying at elevations from 4,700 to 5,500 feet above sea level. The average rainfall is in the neighborhood of 19 inches per annum, but irrigation is required for success-

ful agriculture. The growing season is about five months, and the climate and soil are adapted to the growth of alfalfa, sugar beets, small grains, and vegetables. The Chicago & Northwestern Railway is about 25 miles from the center of the project and the Burlington about 6 miles from its eastern border. It is proposed to construct a reservoir at Bull Lake and to carry the waters from Wind River through a diversion canal about 30 miles along the northern boundary of the project from which branches and laterals will be constructed. This project is ready for construction without delay. About 40,000 acres of the land are in private ownership, 31,000 acres public land, and 13,000 acres State land. The proposed irrigation works will cost about $6,000,000.

Frannie extension, Shoshone project.—This tract contains about 39,000 acres of irrigable lands of which 15,000 acres are unentered public land yet to be supplied with water. They vary in altitude from 4,050 to 4,400 feet above sea level and have an average rainfall of about 6 inches per annum. The growing season is about five months and the climate and soil are adapted to the growth of alfalfa, sugar beets, small grains, and vegetables. Excellent transportation is furnished by the Chicago, Burlington & Quincy Railroad. This tract is a part of the Shoshone project of the Reclamation Service and additional works are required to complete its irrigation. These are estimated to cost about $500,000 and the information is that all is ready to begin construction.

Willwood division, Shoshone project.—This comprises about 18,000 acres of irrigable land situated from 4,150 to 4,450 feet above sea level which has an average rainfall of about 6 inches per annum. It is a part of the Shoshone project and will receive water from the Shoshone Reservoir already constructed, but an independent diversion dam and main canal will be necessary. Construction might begin on this unit very shortly after funds are available, and the works are estimated to cost about $900,000. It is practically all unentered public land.

Heart Mountain extension, Shoshone project.—The present Shoshone project of the Reclamation Service contemplates diversion directly from Shoshone Reservoir already constructed to reach a tract of good land ranging from 4,600 to 5,200 feet above sea level and comprising about 38,000 acres. Transportation is furnished by the Chicago, Burlington & Quincy Railroad running to Cody. Preliminary surveys have been made for this project, but owing to the many construction difficulties involved a number of alternative schemes should be investigated in order to secure the most economical and satisfactory location and designs. Nearly all the land is unentered public land or State land. The proposed works for this extension are estimated to cost about $3,300,000.

Oregon Basin project.—About 68,000 acres of land lying at an altitude of from 4,000 to 5,000 feet above sea level can be irrigated by diverting the waters from Shoshone Reservoir and carrying them to and through the Oregon Basin, which will also be used for storage purposes, and the water delivered to lands in Oregon coulee and along Dry Creek, with possible extensions from Dry Creek to cover lands adjacent to the Willwood division of the Shoshone project. A portion of the area covered by this project was once in-

cluded in a Carey Act project. Surveys are now being made by the Reclamation Service for the purpose of developing a complete irrigation plan and to determine the lands which can be irrigated. None of the land is now under cultivation and it is practically all either unentered public or State school land. The work does not progress sufficiently to permit an estimate of cost, but the information available indicates that a feasible project can be outlined.

Byron-Cowley drainage project.—In Big Horn County, Wyo., the Byron-Cowley irrigation district has been organized and estimates and surveys have been made for draining about 18,000 acres of land included in the district which require drainage. The lands lie from 4,000 to 4,500 feet above sea level, with an average rainfall of about 6 inches per annum, and have a growing season of five months. Good transportation is furnished by the Chicago, Burlington & Quincy Railroad. The climate and soil are adapted to the growth of hay, small grains, and vegetables. The probable cost of the drainage works necessary will be in the neighborhood of $400,000.

Guernsey Reservoir.—A short distance above the town of Guernsey, on the North Platte River, it is proposed to construct a reservoir with a capacity of 70,000 acre-feet to store the winter and flood flow of the river and its tributaries below the Pathfinder Reservoir, and to regulate the discharge from that reservoir. Its utility for the latter purpose is even greater than for the former. The water conserved by this reservoir is to be used for irrigation development along the Platte River Valley, which has been heretofore described in Wyoming and Nebraska. Plans for this work are under way and construction could begin shortly after the provision of necessary funds.

PART II.

REPORT ON INVESTIGATIONS OF WET AND PRACTICALLY UNUSED LANDS IN THE SOUTHERN DIVISION.

By H. T. CORY, Consulting Engineer.

WET AND PRACTICALLY UNUSED LANDS IN THE SOUTHERN DIVISION.

FIELD INVESTIGATIONS.

Limits of the southern division.—The southern division consists of Texas, Oklahoma, Arkansas, Kentucky, West Virginia, Maryland, Delaware, and all States to the south and east thereof—16 in all.

Scope of the field investigations.—All field investigations in the southern district had as their objective the outlining of opportunities for attractive soldier settlement colonies, using these words in the very special sense hereinafter defined. Only to the extent that light was thrown upon such objective were data collected concerning areas of cut-over lands, wet lands, and unused lands in general or in particular. Preliminary investigations early developed the fact that there were numerous attractive opportunities in every one of the 16 Southern States, and that the total acreages available therefor were quite large in each of these Commonwealths, with the single exception of Delaware, although the opportunities in Delaware are as great in proportion to its area as any other State. Thereupon typical projects were examined in considerable detail, tentative reclamation plans outlined, reconnaissance cost estimates prepared and in several States legally binding offerings of very large acreages secured from present owners. Especially is it emphasized that no attempt was made to select the best project site in any one State, but rather to find one or more—usually several—of entirely satisfactory and attractive character and to ascertain in a general way the actual and relative extent of each Commonwealth's resources for such special purpose.

Personnel.—The investigations in Oklahoma, Kentucky, and West Virginia were begun by Mr. H. B. Griffith, a widely known attorney with much experience in land development. Unfortunately he was called away from the work on the signing of the armistice and was worthily succeeded by Mr. George R. Wheeler, formerly of the War Trade Board.

The reconnaissance examination of projects in North Carolina was made by Mr. E. D. Vincent, M. Am. Soc. C. E., engineer of the United States Reclamation Service, and formerly construction engineer of the famous $1,800,000 Laguna Dam across the Colorado River near Yuma, Ariz. Corresponding work in South Carolina was done by Maj. E. P. Bebb, Assoc. M. Am. Soc. C. E., of the engineering division of the service, and in Georgia and Florida by Mr. D. W. Cole, M. Am. Soc. C. E., former project manager of the United States Reclamation Service Boise project.

Mr. D. W. Ross, M. Am. Soc. C. E., the well-known western consulting engineer, formerly supervising engineer of the United States Reclamation Service and later general manager and chief engineer of the largest irrigation colonization project in the Sacramento Valley, had general charge of the work in those States commercially tributary to New Orleans, viz, Louisiana, Texas, Mississippi, Alabama, Arkansas, and Tennessee. He was assisted by Mr. P. W. Welty, Assoc. M. Am. Soc. C. E., recently superintendent of the Cameron County water improvement district No. 2, in Texas; Mr. L. G. Sinnard, the western colonization expert, for several years with the Atascadero projects, San Luis Obispo, Calif., and several others.

The southern district has been in charge of Mr. H. T. Cory, M. Am. Soc. C. E., who made the reconnaissance examinations in Maryland, Virginia, Delaware, and parts of Florida, and the regional inspections of certain other States, viz, North Carolina, South Carolina, Georgia, and Florida.

Especial thanks are due a number of organizations and individuals for hearty cooperation and valuable assistance in many phases of the work. Among these bodies are the chambers of commerce at Waco, Beaumont, Houston, and San Antonio, Tex.; Memphis, Tenn.; Birmingham and Montgomery, Ala.; Lake Charles, La.; Oklahoma City, Tulsa, and Pawhuska, Okla.; Louisville, Ky.; Commercial Club of Nashville, Tenn.; Association of Commerce and the Southern Pine Association, New Orleans; the Florida Tick Eradication Committee, Jacksonville, Fla.; the Morgan Engineering Co., Memphis, Tenn.; the Southern Engineering Co., Clarksdale, Miss.; the Isam Randolph Engineering Co., Chicago, Ill.; and numerous State councils of defense, State officials, State agricultural colleges and experiment stations, State and regional special committees, and quite a few southern railroads.

The individuals rendering notable assistance were Messrs. Hugh McRea, of Wilmington, N. C.; Clement S. Ucker, of Baltimore, Md.; A. G. T. Moore, of New Orleans; ex-Gov. D. C. Heyward, of Columbia, S. C.; Dr. W. T. Blackman, of Jacksonville, Fla.; Alex K. Sessoms and F. H. Abbott, of Waycross, Ga.; F. L. Finkenstaedt, of Bolton, N. C.; Walter Parker and A. T. Dusenberry, of New Orleans; D. T. Kennedy, of Richmond, Va.; and Dr. Steffens, of Baltimore, Md.

Plan of investigation.—The investigations differed according to local conditions. In some States, questionnaires were sent out to the larger land owners by associations and local committees, and considerable publicity given to the work. In other States, information was acquired more quietly. In every case the purpose was to learn as soon as possible where attractive project opportunities would most likely be found and to outline one or more of them.

There might very well be many million acres of unused land in any given territory, and yet impracticable or impossible to block out a compact project of any considerable size at a reasonable acreage price. Rather unexpectedly it soon became evident that definite project opportunities were numerous as well as acreages of unused and practically unused land enormous, and that the problem was not in finding project sites, but in selecting the best of many.

Further, it was found impracticable to decide upon the most available project sites in any one State until the amount of money available for it was fixed. This is because it is desirable to have rather large colonies in the South, whatever may be the case elsewhere. The reasons for this are in large part the reasons why the trend of emigration has been chiefly westward and but slightly southward.

Consequently no instrumental data were collected; except in the case of Delaware, the probabilities were that costly work would be done on other tracts than the one finally selected.

Unused lands.—In the general sense of the expression, unused lands include, among others, all those parcels or lots not under cultivation scattered about in closely settled and highly developed areas. In the special sense as used herein the term refers to larger areas, most of the lands in which are now not utilized agriculturally or at best in a perfunctory manner.

Types of unused or undeveloped lands.—There is an enormous acreage of unused lands in the southern division, a considerable part of which is well adapted for agricultural purposes. There are five classes of such lands, although these classes overlap a little.

First, there are the mountains of the Appalachian system extending from Pennsylvania southwesterly as far as northern Alabama. The forests originally covering these highlands have been quite largely cut over. Land is often owned in great tracts, chiefly for coal and timber, and the agricultural adaptation is mainly grazing, orchards, and reforestation.

Next are the "abandoned lands" found chiefly in New England and the South. These are often the best areas naturally, that were first settled upon, but which for various reasons were allowed to "go back." Very often they are inferior timber lands as well, and are included as cut-over lands in statistics. The chief factors responsible for abandoned lands are:

(1) Depleted fertility due to poor agriculture.
(2) Social and economic changes due to the Civil War.
(3) Competition of newer agricultural areas.
(4) Dearth of agricultural man power after the war.
(5) Increased tenantry resulting.

These southern "abandoned lands" are chiefly found in the Piedmont and sub-Piedmont territories are in the "rice-land" stretches along the rivers near tidewater.

Another class is cut-over land. Originally there was pine forest all along the Atlantic and Gulf coasts from Norfolk, Va., to Galveston, Tex. This has been pretty well cut over, and in the coastal plain the land left has until recently been considered an almost valueless by-product. A considerable part of this immense area is best adapted to reforestation, but a great deal is well suited for high agricultural development.

The fourth class is made up of the "wet lands." These are of two types—"swamp" and "overflowed." The latter are along the many southern streams which have severe flashy floods, but are largely bottom lands along the Mississippi River. The former are chiefly along the Atlantic and Gulf coasts from Norfolk, Va., including most of Florida, to Brownsville, Tex., at the Mexican border. The total area of wet lands, while enormous, is but a fraction of the cut-over lands. Further, much of the wet lants are cut-over lands also.

The last class is found in but one State of the southern division—Texas—and is land which needs to be and can be irrigated. The precipitation curves show that throughout the entire division except western Oklahoma and west Texas the rainfall is ample and well distributed for general agriculture on ordinary soils. The rainfall variations in Oklahoma and Texas should be particularly noted, the former being especially interesting as the differences range from 50 to 16 inches in 400 miles and from 50 to 30 inches in 180 miles.

Distribution of unused land.—The location of the third and fourth classes of unusued lands are shown on the maps, Plate II and Plate III, of the United States and of the southern district. The first of these shows at a glance why the opportunities for attractive soldier settlement projects are relatively so abundant in the South. Of course many factors must be considered—amount of unused land, size of present holdings, and ability to block up reasonably compact projects, soil fertility and crop adaptation, land prices, costs of complete reclamation (using this term in the special sense hereinafter defined), transportation facilities—railroads and main highways—character of and nearness to markets, sociological environment, climate and healthfulness, anticipated prices for the most important agricultural products, probable extent of "unearned increment" in the reasonably near future, etc. Comment upon certain phases of colonization in the South will be found under a subsequent heading. Suffice it to say that careful consideration of the region as a whole was given and the conclusion seems unavoidable that the maps quite truly indicate the actual as well as the superficial extent of soldier settlement opportunities in the South and that—

(1) The existing resources in the way of planned rural development opportunities within the southern division at least equal those of any other part of the United States.

(2) Such existing resources are so located with respect to State boundaries as to suggest essential equality of soldier settlement operations in each of the several States, except Delaware, Maryland, and Texas.

Real value of unused lands.—The simple fact that almost all the land in any considerable area anywhere in the entire country is almost or wholly agriculturally undeveloped, is prima facie evidence that something serious is wrong with it. It is all very well to say that many times erroneuos preconceived ideas carry on indefinitely—sometimes, of course, they do—or that some day the changed conditions will show the true worth, etc. As a matter of fact, however, the American is so great a rover, is so alert to "make a turn," and has such omnipresent agencies for collecting and transmitting facts and ideas, that "bargains" nowadays do not lie around above ground for very many years anywhere within the Nation's borders. For this reason many people urge that trying to establish the returned soldiers, sailors, and marines upon large tracts of waste, cut-over, swamp, and arid lands is a poor way of displaying national gratitude and helping those heroes to get on in the world.

The real facts are that the trouble with some unused lands can be obviated with expenditures upon ordinary scales and within reasonable periods of time; and with other unused lands only with enormous expenditures or great lengths of time or both.

Most unused land in the southern district is of the latter type, and not a little will command any considerable price only in the rather distant future. The trouble with much of it, however, can be completely cured for surprisingly low costs and in very short spaces of time if done by operations on a very large scale.

The trouble with "abandoned lands" in the southern district is less fundamental than in many other localities. George Washington was the richest man in America when he died and his property consisted of negro slaves and a little less than 6,000 acres of Virginia land, of which to-day but a small portion is farmed. Generally speaking, the fertility has been depleted, but that can be restored at quite reasonable costs and in a relatively few years.

But relatively low productivity has brought in its train something far more difficult to handle. It is locality "backwardness." The ambitious have steadily gone out to more promising fields of human activity with the result that little and often negative progress has been made in local community life, while throughout the Nation as a whole, in rural as well as industrial communities, advances in civilization have been very great.

Thus it is that while "abandoned land" can be brought back often to high fertility much cheaper than raw lands in new sections can be subdued, or in progressive sections purchased, nevertheless its desirability and hence its sale price when renovated is often less than the necessary expenditures upon it. In other words, a fertile, revamped farm in the midst of a large area of abandoned land would have so much less real value than were it in the midst of a progressive region. Only part of the trouble can be removed by any individual, the low fertility and the rest of it will normally take a long time according to American standards.

To do the job completely it is necessary to treat relatively large compact tracts as a whole, and not only renovate the soil but also wipe off the existing developments to such an extent as to quite obliterate social institutions, folkways, standard of living, and habits of thought, and establish in place thereof modern communities. This, however, requires large amounts of money under one control—in other words, operations on a large scale.

Similarly, the real value of a thoroughly up-to-date, completely developed farm in the midst of a great tract of cut-over land is quite low. The few inhabitants almost invariably have low standards of living and social interests, and the time normally required for the region as a whole to develop is too long to make the investment of money and nervous energy in producing a good farm attractive to the ambitious man. But if really large tracts are taken and entire communities treated in one operation the total costs will be very well worth while—again a matter of operation upon a scale far beyond the reach of individuals, even though assembled together in cooperative organizations of a practicable size.

With wet lands the case is even more aggravated in that an individual farm is not generally possible without comprehensive drainage systems or levee systems, or both. Proper sanitation requires mesquite abatement and this can not be successful on a small scale.

Few desirable areas of any size in the southern district, i. e., in Texas, which require irrigation are yet undeveloped areas, except those the irrigation works for which must be very large and costly.

In some cases the acreage cost for complete reclamation is too high to be attractive under present conditions, but even when this is not the case only operations on a very large scale are to be considered, usually.

In short, the way most economical both in money and human struggling and tragedy, and often the only feasible way, to get into use or reclaim "unused lands" is by large-scale operations and planned rural communities. The investigations which are the subject of this report disclosed the fact that there are enormous acreages of these lands, which can be profitably reclaimed and which would then be admirably adapted for agricultural purposes.

Land settlement in the South.—The thought naturally suggests itself that 25 years ago the utilization of arid lands in the West reached a stage where further progress involved operations upon large scales, yet the last two decades have been most glorious in achievements, and only very large scale or scattered opportunities are now open. How, then, does it happen that so many opportunities are yet available in the South?

It is indeed peculiar that the real frontier in America is in the Atlantic and Gulf coastal plain. The South has lagged behind the country, and particularly the West, in land settlement, and the reasons therefor are not only interesting but throw important light upon the nature and kind of soldier settlement projects most desirable there. These in approximate order of their importance are:

(1) The history of the East, the South, the Mississippi Valley, and the West as the characteristics of original colonists, types of agriculture they brought with them and developed over there, methods of acquiring land holdings, conditions of labor, etc. There are so many thoughts suggested in this sentence that lack of space alone prevents yielding to the temptation to elaborate upon it.

(2) The slogan "Go West, young man, and grow up with the country." It was the logical outgrowth of American sociological conditions prior to Appomatox, and so it had a most effective punch. In modern terminology the expression per se was propaganda most far reaching in its effects upon those types who follow the crowd rather blindly.

(3) Numerous areas of practically free Government lands in the Middle and far Western States.

(4) The widespread impression that the sentimental differences between the North and the South because of the war tend to make newcomers uncomfortable.

(5) The ideas current outside the South of the Negro's anomalous place in the social, industrial, and agricultural life of the region and the natural inference that the white manual laborer's social caste is lower in Dixie than elsewhere in the country.

(6) The feeling that the South is unhealthy because of the sectional epidemics of yellow fever, prevalence of malaria, and exclusive home of the hookworm. Though it has been known for a good many years that the first two of these diseases are misquito borne and that all are preventable, the prejudice lingers yet.

(7) The idea that the long, hot summers and the short mild winters constitute climatic conditions tending to slow undermining of aggressiveness and enterprise. It is kept alive by the outside impres-

sion of commercial, industrial, and, to a less extent, agricultural development in the Southeastern States.

(8) The existence of enormous forest areas from Norfolk, Va., to Galveston, Tex., along the Atlantic and Gulf coastal plains and extending well back into the Piedmont regions. These are largely cut-over lands now.

(9) The holding to money-crop agriculture—tobacco, cotton, or corn, as the case may be—in considerable part due to tenantry since the war.

These and quite a few other but less important factors are responsible for the South's failing to share in empire building with the West in proportion to natural resources therefor.

Success of soldier settlements.—In the face of so marked a national phenomenon the wisdom of attempting soldier settlement work in a large way naturally suggests itself.

Whatever might have been the case 25 years ago, the conditions in the southern district are now as favorable, all things considered, as in the North and West, provided, and only provided, the community settlements are of considerable size.

The movement westward has resulted in making agricultural land values really higher in the Western States, everything considered, than elsewhere in the country. Then it turned north, and 1,600,000 Americans have gone over into Canada during the great settlement movement of the Canadian northwest begun a few years before the World War. There are a few sporadic instances indicating that the beginnings of a trend back and to the South are in evidence. Doubtless these will steadily but slowly increase. The plain facts are that something spectacular is necessary to break up the existing psychology not only of the American people but of foreign immigrants to America as to the relative opportunities in the South and in the West for securing agricultural homes.

After careful examination of many data and numerous conferences with leading southern public-spirited men, the only thing that is at the same time practical and probably successful to be thus far suggested, is for the United States Government as such to place its stamp of approval upon numerous sections throughout the South. Of course, this has in effect been done, in that one department has approved of its soil conditions; another department has investigated and published many data concerning its biological features; and a third has been giving publicity to crop adaptations, etc., but all of these facts go out independently and piecemeal—one might say, ooze out—and attract little attention.

Thus it is that soldier settlement projects well scattered throughout the South would have an indirect result perhaps more far-reaching and significant than all the direct results combined. They would afford a noteworthy form of the National Government's stamp of approval upon certain typical southern agricultural home opportunities, and doubtless do more to change the attitude of the American people in respect to settlement tendencies westward and southward than would normally occur in several decades. Much of the public's attention will be centered upon soldier settlement projects wherever located, but information concerning such matters in the West would but be " more about the broken window " because of the great amount of publicity which has been given to the Reclamation Service projects

during the past 16 years. The descriptions of southern soldier settlement projects in technical and popular journals, magazines and periodicals, on the other hand, would be sounding a new note and would attract more than a proportionate amount of attention.

Consequently the soldier settlement colonies in the Southland would mean more, and be far more helpful to that region than similar colonies in other parts of the United States.

Another feature of southern soldier settlements is that they should in general be large. Size is a more important element of success here than elsewhere because there is more "backwardness" in the rural population throughout the cheap land areas of the South than elsewhere and particularly in the West. Undue dependence has been placed upon Negro labor and one-money-crop agriculture is too generally practiced. In localities where soldier settlement opportunities would probably be located the agricultural status is much behind the times. Consequently here more than anywhere else it would be desirable to minimize the influence of folk ways, social institutions, and agricultural methods, and begin from the ground upward to create a totally new community life, to insure which communities must be relatively large.

On the other hand, by this same token, the southern colonies will be among the most attractive per se of any in the country—that is to say, the planned rural communities will begin here more nearly with clean slate than almost anywhere else, so that the final result will grade high in the scale of modernity. They will also enjoy in their settings well nigh the greatest degree of "unearned increment" increases.

Summarizing, then, the success of soldier settlements upon the unused or partially used southern lands should be great, due to:

(1) Completeness of project as a planned rural community.

(2) The relative advance in planned rural development over the existing local standards.

(3) The far-reaching effect upon the whole southeastern part of the United States by numerous demonstrations of the country's natural resources as distinct from its agricultural development up to this time.

Typical soldier settlement opportunities.—A brief statement follows concerning the conditions obtaining in each of the 16 States comprising the southern district with respect to soldier settlements. In all except Delaware numerous project opportunities were found and undoubtedly there are many more that would be brought forward on giving organized publicity along State-wide lines of being ready to begin work upon a definite basis.

Space would not permit describing even briefly each of the several project opportunities gone over, so that in general but one in any one State is specifically outlined. By no means, however, should it be inferred that the project selected for description is the one most favored either by the respective States soldier-settlement committee or by representatives of the Interior Department. Projects were arbitrarily chosen, chiefly with a view to presenting in some detail the facts concerning an opportunity generally typical of those in any one State. It is particularly desired to emphasize the fact that projects selected for description are under no circumstances to be considered as being the most available or the most desirable of those in the State concerned.

What is meant by a completed or going-concern farm.—In this report the expression "completed or going-concern farm" is used as meaning a farm averaging about 50 acres in size with the following characteristics:

(1) Home and farm buildings.
(2) Fencing.
(3) Two-thirds the land ready for cultivation, completely cleared.
(4) Remaining third thinned out for pasturage.
(5) All drainage systems, project and individual, completed.
(6) All land for cultivation completely dosed with lime, etc.
(7) All project public roads built.
(8) All sanitation and mosquito abatement work done.
(9) Five hundred dollars' worth of stock and farming equipment.

Raw and developed land values.—Until within a relatively short time ago, raw land values (in the Atlantic and Gulf coastal plain particularly) were quite low. Cut-over land was even considered as a practically valueless by-product of lumber. Many million acres of wet lands were sold in large blocks at 10 and 25 cents per acre.

The value of agricultural farm lands in the United States has trebled since 1900—in the past 19 years—and this has had a marked effect upon the selling price of undeveloped lands in the South as well as elsewhere. Landowners have quite generally discounted the increase due to general development throughout the region, and it is quite interesting to note the uniformity of the asking prices for land of this type throughout the entire territory. Apparently this has risen from $1 to $10 per acre in the past 15 years.

It may be interesting to inquire concerning the reasonableness of such increase and as to how far it is justifiable under the circumstances. It would, however, be academic, because there is little chance of these land values being reduced in the immediate future at least, and every probability is that they will continue on up. It might have been fortunate could lands for soldier-settlement projects have been secured 10 years ago, but they were not. The condition, not the theory, exists, and land prices seem to be consistent quite generally throughout the southern district.

The values of such lands fully developed.—Another interesting feature—taking the most obviously attractive soldier-settlement projects—is that the final cost of a completed farm in the sense herein used, is surprisingly near the same all over the territory. In one case the expense for drainage will be more, in which event the cost for clearing will be less. In another, road building will be more difficult and soil treatment simpler and cheaper. Except in the case of the suggested stock-raising colonies in the Appalachian Mountains, the probable cost of completed farms hovers surprisingly close to $120 per acre.

Probable value of completed farm lands.—Naturally one of the first questions which would properly be asked about soldier-settlement land is the relative cost to produce completed farms and the probable sale value on completion. It is just as plain that the probable average cost on a diversified farming project, regardless of location throughout the district—taking the most attractive opportunities, of course—hovers close to the $120 per acre. A thing of vital importance to the plan, and particularly to the prospective soldier purchaser, is the value of the land immediately after possession of the place has

been turned over to the proposed settlers. This probable value is rather difficult to estimate except upon the basis of prices now obtaining for really attractive farm tracts within a few miles of the larger settlements. On such a basis, the average value of the completed farm would be at least $150 per acre—anyway, a 20 per cent leeway over and above cost.

SUMMARY.

Summarizing the conditions in the 16 States in the southern district, it is evident that:

1() In every State but Delaware there are numerous soldier-settlement opportunities.

(2) That in all of the States except Delaware the problem is not to find suitable project opportunities but to select the most available one.

(3) That there is quite a surprising similarity of project-opportunity resources in all of the States except Delaware, and, to a lesser extent, Maryland.

(4) That there is a very marked uniformity of basic raw values, and also of the final costs of completed farms.

(5) That the leeway of market value over cost of completed or going-concern farms should average at least 20 per cent.

ALABAMA.

The investigations in Alabama have been carried on in cooperation with the committees appointed by the governors of the State. The first committee was named in the fall of 1918 by the Hon. Charles Henderson, then the State's executive, and consisted of: Gov. Charles Henderson, chairman, Montgomery; W. J. Harlan, Lockhart; Richard M. Hobbie, Montgomery; H. H. Snell, Birmingham; Allen Northington, Prattville; R. B. Barnes, Opelika.

This committee was replaced the latter part of February, 1919, by the Alabama Post-War Council of Defense, a body created by the legislature just adjourned, to handle the State's reconstruction and other postwar problems, and is now constituted as follows: Gov. Thomas H. Kilby, chairman, Montgomery; Fred H. Gormley, vice chairman, clerk of house of representatives, Montgomery; Dr. J. F. Dugger, director Alabama Experiment Station, Auburn; Mrs. James F. Hooper, Selma; Dr. Thomas M. Owen, director of history department, Montgomery; W. S. Keller, State highway engineer, Montgomery; Dr. W. S. Welch, State health officer, Montgomery; Spright Dowell, State superintendent of education, Montgomery; M. C. Allgood, commissioner of agriculture, Montgomery.

The total area figures for the State are:

	Acres.
Land	33,000,000
In crops	10,600,000
Unimproved in farms	11,000,000
Merchantable timber	5,200,000
Cut-over land	15,000,000
Swamp land	900,000
Wet grazing land	60,000
Overflow lands	525,000

Total number of farms, 280,000.

That is to say, nearly half the State consists of cut-over lands, only one-third cultivated, and relatively little is wet or swampy.

In general, the southern third of the State is coastal plain, the middle third the so-called central highlands, and the northern third foothill country. The southwestern tip lies below the 100-foot contour, the coastal plain below the 300-foot contour, the central highlands between the 300-foot and the 1,000-foot contour, and the foothill section from the 1,000-foot contour up to a maximum elevation of 2,400 feet. The surface, particularly of the coastal plain, rises quite steadily from the coast and streams.

The coastal plain and central highlands were generally covered with fine long-leaf pine timber, most of which has been cut over. The recent cuttings are quite thorough and in some cases even the small hardwood trees are removed, leaving an open expanse of stump and brush. In older tracts the brush has been burned and in its place are scrub oaks and bushes, and often young pines. In the older tracts timber was cut sparingly—sometimes 30 years ago—and now there are not only good-sized second-growth pines but some of the original long-leaf trees and the hardwoods. Here second cutting is going on to some extent.

From the 15,000,000 acres of cut-over and wet land, it is relatively simple, by the process of elimination, to segregate the 10 per cent best suited for soldier settlement, taking into account topography, soil, transportation, land ownerships, extent and character of rural development, nature of surface vegetation, and prices. The selection of the best 100,000-acre project from such 10 per cent was not attempted and should be made by the Alabama postwar council of defense and the Interior Department acting jointly. It is believed that soldier settlement work in this State should be concentrated in one project.

Consideration has been given several feasible projects in the State; others have been suggested, but have not yet been examined, and doubtless there will be still others to claim attention when the authority and funds are provided for the actual initiation of development plans. In this report the essential facts relative to only one typical opportunity are given. The data, however, are fairly applicable to several others, a detailed description of which, therefore, would be superfluous at this time. The final selection of a project or projects, it is understood, of course, will be determined jointly by the postwar council of defense and the Interior Department after careful consideration of all offerings.

The Brewton project.—The Brewton project is located in the north central part of Escambia County and the south central part of Conecuh County, Ala., and in the northern end of Santa Rosa County, Fla. Brewton, Ala., with a population of 2,500, is the county seat of Escambia County, and is on the main line of the Louisville & Nashville Railway from New Orleans to Montgomery. The Pensacola and Selma branches skirt the western edge of the project and no lands are over 6 miles from a railroad.

The elevation varies from 50 to 300 feet above sea level. The country varies from rolling to undulating, with possibly 20 per cent of the land rough and 10 per cent swampy along water courses. The drainage is good and the creeks have good fall. Very little of the

land is topographically unsuited to cultivation, most of the upland requiring neither ditching nor terracing. A considerable part of the second bottoms need, in addition to drainage, a little diking to prevent overflow.

The United States Bureau of Soils in cooperation with the Alabama Department of Agriculture and Industry has made soil surveys of the west end of Santa Rosa County, Fla. (in 1906) and of both Conecuh (in 1912) and Escambia (in 1913) Counties, Ala. According to these, agriculture, particularly in Escambia County—

is in its infancy. Lumbering and turpentining have been the dominant industries in this county for a number of years. The merchantable timber has now been largely removed, and extensive areas are available for agricultural occupation. About 90 per cent of its area consists of cut-over lands and forests of mixed timber and pine. The agricultural development has been very slow until recently.

Escambia County promises to become one of the most promising agricultural counties in the State. Its topography and climate, wide diversity of soils, and abundant water supply are favorable to a successful agriculture, including the production of a wide range of crops and the development of the live-stock and dairy interests. (Field Operations of the Bureau of Soils, 1913, United States Department of Agriculture, pp. 831–870.)

The growing season has an average length of 260 days, affording ample time in which to mature at least two principal crops in a single season.

As to climate, the mean temperature during the summer months is 82° with a maximum of 105°, the nights being pleasant because the prevailing winds are from the south, cooled by the Gulf. The winters are mild with a mean temperature of about 50°, a minimum seldom below 12°, and the prevailing winds from the west. Snow seldom falls and ice forms only occasionally. The mean rainfall is about 58 inches, is heaviest during the summer months and lightest during the fall or harvesting time, and is generally adequate and well distributed for the successful growing of crops. Droughts are practically unknown.

The country is well watered, and good well water is found on the uplands at a depth of 12 to 50 feet. Artesian water of excellent quality is obtained at from 40 to 1,200 feet and there are many springs—one large one about 14 miles east of Brewton has a flow of about 2,000,000 gallons daily.

The land in this project is held in quite large tracts, five interests alone controlling a total of 178,000 acres in almost a solid block.

The price asked is $10 per acre.

The reclamation work would consist of some drainage and leveeing, clearing, addition to the soil of lime, nitrate of soda, phosphate, and humus, and road building.

Going-concern farms—using the term as hereinbefore defined—would certainly cost not to exceed $125 per acre, so that a 80,000-acre soldier settlement would require not more than $10,000,000.

A good demonstration of the suitability for soldier settlements of this general region has been made by several colonies near Foley, Baldwin County, Ala., about 25 miles to the southeast, where the climate and soil conditions are essentially the same. These colonies have been established during the last 12 years. The average size of farm unit is about 40 acres. The agriculture is diversified, the roads are good, and the people evidently prosperous. Indeed, several of

the newer places would be a credit even to California, where so much money has been spent on show places and in demonstration work.

ALABAMA POST-WAR COUNCIL OF DEFENSE,
Montgomery, Ala., May 13, 1919.

Mr. H. T. CORY,
Consulting Engineer, United States Reclamation Service,
Washington, D. C.

DEAR MR. CORY: My delay in answering your telegram has been due to my desire to obtain from our committee opinions about the copy which you furnished me. It has been returned with the statement that there was no need for a further statement in connection with the Alabama projects than that the Alabama Post-War Council of Defense holds options on something over 200,000 acres of land which we are prepared to submit to you at any time.

Many requests for information about soldier-settlement colonies in Alabama have come from Alabama soldiers who desire to engage in farming, and the idea is one of the most popular I have ever known in this section. Your attention is called to the inclosed resolution adopted by the two houses of the legislature urging Congress to take prompt action.

You may be assured that when Congress has approved the plan the post-war council of defense will assist the Reclamation Service in its efforts to obtain the most suitable project or projects in Alabama.

Yours, truly,

FRED H. GORMLEY, *Vice Chairman.*

ALABAMA AGRICULTURE AND INDUSTRIES DEPARTMENT,
Montgomery, May 19, 1919.

Mr. FRED H. GORMLEY,
Vice Chairman Alabama Post-War Council of Defense,
Montgomery, Ala.

DEAR MR. GORMLEY: I have taken great pleasure in going over the surveys made in Alabama by Mr. H. T. Cory, consulting engineer of the United States Reclamation Service, and I want to assure you that his report of conditions in Alabama are true and that the State department of agriculture is prepared to assist the Federal Government in whatever future investigations it may care to make of Alabama lands suggested for the soldier-settlement colonies.

Lands around Brewton and contiguous territory, including the project especially mentioned by Mr. Cory, are excellent for farming and cut-over lands in this section can be available for agriculture after the expenditure of reasonable amounts for improvements.

The department of agriculture is prepared to lend whatever assistance the Federal Government and Alabama Post-War Council of Defense may need in this matter.

Yours, truly,

M. C. ALLGOOD,
Commissioner of Agriculture and Industries.

ARKANSAS.

The investigations in Arkansas have been carried out in cooperation with a committee appointed by the Arkansas State Council of Defense, consisting of Fred Heiskell, chairman, Little Rock; Leo Andrews, Pine Bluff; Allan Kennedy, Fort Smith; Bruce Campbell, Helena; Henry Moore, jr., Texarkana; Gen. Lloyd England, Little Rock; E. J. Bodman, Little Rock; C. T. Coleman, Little Rock; M. W. Hardy, Little Rock; D. C. Welty, Little Rock.

The total area figures for the State are:

	Acres.
Land	33,600,000
In crops	7,400,000
Unimproved in farms	9,300,000
Merchantable timber	6,500,000
Cut-over lands	14,500,000
Swamp lands	5,250,000
Wet grazing lands	50,000
Overflow lands	530,000

Total number of farms, 230,000.

That is to say, nearly half of the State consists of cut-over lands. Less than one-fourth was cultivated last year, and about one-sixth is technically classified as swamp, although actually much drainage has been completed since the census.

In a general way the northwestern part of the State comprises an inland terrace above the 500-foot contour, the remainder being coastal plain and alluvial valley. The highest point is 2,800 feet above sea level; the lowest, 55 feet; and the mean, 650 feet.

Although years of experience have proven the hill and mountain area to be excellently adapted to building up prosperous communities with fruit, truck, and live stock as their principal activities, preliminary investigations were confined to the alluvial and coastal plain land in view of lower development expense per farm unit.

Questionnaires were filled out by 86 owners having lands in 36 counties and covering 3,600,000 acres. Of this approximately 2,000,000 acres were inspected by five field agents, two of whom were land and colonization experts loaned by the Missouri Pacific Railroad, one an agronomist and one an agriculturist, who have been until recently with the Arkansas Agricultural College, and one a civil engineer, who has had considerable experience throughout the alluvial part of the State.

To check the dependability of prices named in the questionnaires, legally binding options were secured on a large scale by and in the name of local committees in Arkansas and five other States. The area in Arkansas thus covered was 625,000 acres. The result of such work in this and in the other five States indicates that when it is possible to deal on a definite basis with owners land can be secured at prices generally lower than those set forth in the questionnaires. The Arkansas committee conscientiously endeavored to secure the listing of lands at rock-bottom prices. Lack of definite information, however, regarding terms of payment, interest rates, and ultimate provisions of the then pending income tax as to excess-profit and other taxes, and the impracticability in the limited time of seeing personally all those in authority, hampered the committee in its work. In several cases only nominal prices were secured. In many cases owners in conversation suggested lower prices than those contained in the options given.

There are three tracts in the alluvial area and six in the coastal plain area which are considered most adaptable of the lands thus far offered under option. These were given a second inspection by a committee consisting of Mr. D. C. Welty, commissioner of agriculture of the Missouri Pacific Railroad; Gen. Lloyd England, cashier of the England National Bank of Little Rock and chairman of the Arkan-

sas State Council of Defense; and Mr. C. W. Watson, assistant director of agricultural extension of the Arkansas Agricultural College.

The Arkansas soldier settlement committee has been ready since March 1, 1919, to suggest nine definite project opportunities and submit essential data regarding them, together with information regarding the prevailing land prices which would insure the most advantageous buying. At the same time, when authority and funds are provided for the soldier settlement plan, no doubt at least half as much more land will claim attention, or a total of 5,000,000 acres.

Although nine Arkansas tracts have been selected as adaptable, the essential facts will be given relative to only two typical opportunities—the Sheridan project, which is located near the center of the State close to Little Rock and Pine Bluff, and is typical of tracts in the coastal plain area; and the southeastern Arkansas project, which is typical of the greater portion of the alluvial section of the State.

The Sheridan project.—This project is located about 25 miles south of Little Rock, the capital of the State, and comprises almost the whole of Grant County, with the exception of a narrow strip along the western boundary, and small areas in the southeastern part of Saline, the southwestern part of Jefferson, the northwestern part of Cleveland, and the northwestern part of Dallas Counties. Sheridan, the county seat of Grant County, is located almost in the center, has a population of 1,000, and is on the Missouri Pacific Railroad. The Chicago, Rock Island & Pacific Railroad skirts the western edge of the project.

The land surface is undulating to gently rolling, with an elevation of from 150 to 300 feet above sea level. The drainage of much of the forested uplands is deficient, owing to the level topography; however, in other than very limited areas only surface drainage is necessary. In fact, when timber and underbrush are cleared off and fields and roads opened, the greater part of the drainage problem is solved. Many of the streams of this section are intermittent.

Although the forests of pine and oak with which the uplands were originally covered have been removed, there still remain extensive areas of merchantable timber. Eighty per cent of the land is cut over, and since very little of the cut-over lands have been cleared for farming, a very small per cent is in cultivation. Lumbering is still an important industry.

In 1916 the United States Bureau of Soils made a survey of Jefferson County, which touches the project on the eastern edge. According to this and to investigations of the area of the project not included in the survey, the soil of the uplands is mainly Caddo silt loam and sandy clay loam, ranging in depth from 2 to 10 feet. The subsoil for a depth of from 4 to 8 feet is grayish to red clay, which deep-rooting plants penetrate easily. The uplands have two general types of soil, both of very fine texture. On the higher points the type is similar to the Villas fine sandy loam, while on the slopes the soil has the character of Norfolk fine sandy loan, all underlain with a compact clay subsurface soil and with a semiporous clay base beneath the subsurface. On limited areas of hardwood lands scattered throughout the project the soil ranges in depth from 3 to 6 inches of heavy loamy clay with a considerable amount of decomposed vegetable matter. The color is a dark

brown, shading into brownish black, underlain with a semiporous clay of brownish coloring. These lands are rated as the best types of clay-loam soils for all grain and cane crops.

The rock underlying the whole of this region outcrops in isolated districts only. The entire area is covered with grass. Altogether it is essentially an agricultural country, well adapted to diversified crops, the principal of which are corn, cotton, truck, and fruit crops.

The mean temperature during the summer months is 81°, with a maximum of 108°. The winters are comparatively short and mild, with a mean temperature of 44.3° and a minimum of 5°. The ground freezes to a depth of more than a few inches very seldom, and the snow rarely exceeds a depth of 1 or 2 inches and soon melts. The mean annual precipitation is reported as 51.15 inches and is heaviest in the winter, when it is sometimes excessive. Droughts are rare.

The average date of the last killing frost in the spring is March 26, and the first in the fall, November 2, giving a normal growing season of 221 days.

Wells are plentiful and the water abundant and of a high grade. The first strata of water is found at a depth of from 15 to 30 feet.

The land in this project is owned in quite large blocks, seven interests controlling 220,000 acres in the area. Three interests alone control over 145.000 acres.

As stated in the foregoing, it was difficult for the Arkansas committee to get definite and minimum prices on land when terms of purchase were so indefinite, but it was ascertained, however, that the cost will be less than $10 per acre.

The southeastern Arkansas project.—This project is located in Chicot County, 10 miles south of Dermott, a town of 3,000 people, and 4 miles west of Lake Village, the county seat of Chicot County, with a population of 2,000. Both are located on the main line of the Missouri Pacific Railroad, which runs just to the west of the project. A branch line runs just east of the project and another runs east and west across the area. The main Arkansas-Louisiana highway will be built through or closely adjacent to the tract.

The land surface is quite flat with an average elevation of about 150 feet above sea level. A main ditch and several others have been dug already to drain the greater part of the project.

Practically all of the land is cut over and very little has been cleared for farming, so a small per cent is in cultivation.

In 1913 the United States Bureau of Soils made a survey of Ashley County, which comes within a mile of the western edge of the project. The soil is alluvial in origin and of the Portland series—that is, Portland fine sandy loam and Portland clay. Cotton and corn are the principal crops. Alfalfa is being grown very successfully and in fact all diversified crops thrive on the soil tvpes here. The original forest growth was sweet gum, white pine, willow, red and post oak, black and shellbark hickory, and holly. There is no outcropping of rock and the entire area is covered with grass. This is essentially a rich agricultural region.

The mean summer temperature is 92° with a mixiumum of 110°. The winters are comparative short and mild with a mean tempera-

ture of 58° and a minimum of 9°. Heavy snow is practically unknown. The mean annual precipitation is 53.83 inches and is heaviest in the winter and spring months. The summers are fairly dry. The average date of the last killing frost in the spring and the earliest in the fall are March 27 and October 29, respectively, giving a normal growing season of 216 days. Wells are plentiful and abundant water of excellent grade is found at a depth of from 8 to 25 feet.

The major portion of this project is held by one owner who has 32,000 acres. The remainder of the project is in tracts of 2,500 to 10,000 acres. It is known that this land can be purchased for less than $20 per acre.

The reclamation work would consist of drainage, road building, addition to the coastal plain soils of lime, phosphate, potash, and nitrogen, and especially clearing. Completed farms in the project would cost not to exceed $125 per acre, or not more than a total of $10,000,000 for a 80,000-acre tract, which is about the size of the colony recommended.

ARKANSAS STATE COUNCIL OF DEFENSE,
Little Rock, May 12, 1919.

MR. H. T. CORY,
Consulting Engineer,
In charge of Southern States for Soldier Settlement,
Washington, D. C.

SIR: I have read with care the report which is to be submitted to Congress by you and have no criticism of it, except that it must seem to one who knows Arkansas to be ultra-conservative in its reference to Arkansas lands.

Vast areas in Arkansas have been built to wonderful richness by the silt deposited through the ages by our rivers. Much of this land is now in timber or has been cut over. I believe there is no richer land in this country, and little that will average so high. This land, which could have been bought for a few dollars per acre 25 years ago, now sells in many cases for more than $200 per acre. It is such land as this that will be offered to the Government in the alluvial project referred to in your report.

The Arkansas committee, of which I am chairman, has given several months of work to the farms for soldiers movement and as a result of this work Arkansas will offer the Government at a low price valuable lands in the coastal plains area as well as in the alluvial area.

The Arkansas committee is composed of men who know Arkansas, and who know business, and the committee is impressed with the great value to the State and to the country of this movement, and with the entire practicability of the movement.

Yours, truly,

FRED HEISKELL,
Chairman, Arkansas Farms for Soldiers' Committee.

BUREAU OF MINES, MANUFACTURES, AND AGRICULTURE,
Little Rock, Ark., May 7, 1919.

MR. FRED HEISKELL,
Chairman Arkansas Soldier Settlement Committee,
Little Rock, Ark.

DEAR SIR: I have carefully examined the report of the soldier settlement committee and wish to express my approval of same. Your committee stated the facts and avoided extravagant expressions.

Yours, truly,

JIM G. FERGUSON, *Commissioner.*

COLLEGE OF AGRICULTURE,
AGRICULTURAL EXPERIMENT STATION,
Fayetteville, Ark., May 6, 1919.

Mr. FRED HEISKELL,
Chairman Farms for Soldiers' Committee,
Arkansas State Council of Defense, Little Rock, Ark.

DEAR MR. HEISKELL: I have read with considerable interest Mr. Cory's report on Arkansas's soldier colony opportunities; in fact we have cooperated with Mr. Welty in compiling some of the soils data.

I gladly affirm what has been said regarding the soil in general and its adaptability when developed and managed, and can assure you that the statements made can be considered conservative, especially if my understanding is correct that upon the cheaper coastal plain land, money and effort will be expended to supply organic matter to the soil.

Assuring you of my interest and desire to cooperate, I am,

Very truly, yours,

MARTIN NELSON,
Dean and Director.

DELAWARE.

The committee representing the Commonwealth of Delaware in the soldier-settlement program is the reconstruction commission of the Stae of Delaware, and consisting of Mrs. Charles R. Miller, Wilmington; Mrs. John B. Hutton, Dover; Mrs. Ella Emory, Seaford; W. G. Taylor, Wilmington; Frank R. Poole, McDonough; Arley B. McGee, Dover; and George H. Hall, Milford.

The investigations in this State were carried on prior to the naming of the committee.

The total area figures for Delaware are:

	Acres.
Land	1,257,000
In crops	576,000
Unimproved in farms	500,000
Merchantable timber	55,000
Cut-over lands	100,000
Swamp lands	50,000
Wet grazing lands	50,000
Overflow lands	27,000

Total number of farms, 11,000.

That is to say, nearly half of the land area was in crop during the 1918 season and only one-tenth unused.

In a general way, the entire State is level to gently rolling, the maximum elevation being only 440 feet and the mean only 60 feet above sea level.

All except the northern tip of the State is essentially an agricultural region—first planted to tobacco until 1850, then corn and oats, and latterly wheat, fruit, and dairying. All of this region is coastal plain, and the southern two-thirds of the State is under the 70-foot elevation. The easterly part drains into Delaware Bay and the western part into Chesapeake Bay through the Eastern Shore counties of Maryland. The streams are broad, tortuous, and sluggish, with narrow strips of low, wet ground along them, the slightly higher lands being flat plateaus, the natural drainage of which has been much improved by natural works.

The largest compact undeveloped area seems to be the so-called Cypress Swamp in the south end of the State, which would make

an excellent project, especially if enlarged by contiguous lands in Maryland.

The cypress project.—The Cypress project is located in Sussex County about 12 miles south of Georgetown, the county seat, with a population of over 2,000. The Delaware, Maryland & Virginia Railroad, a part of the Pennsylvania system, runs along the eastern edge and the New York, Philadelphia & Norfolk Railroad, also a part of the Pennsylvania system, passes about 15 miles west of the area. The Dupont Concrete Highway passes close to the northeastern edge.

The project is a flat, poorly drained tract of about 6,000 acres, with an elevation of between 35 and 40 feet above sea level. The United States Bureau of Soils is now making a soil survey of Sussex County, but the results have not yet been published. In 1903 such a survey was made of the Dover area. It is evident, however, that the Norfolk and Portsmouth loams are the preponderating soil types, well suited to a varied agriculture in which corn and wheat crops predominate.

The climate is even and mild. The slight difference between the day and night temperatures, due to the broad reaches of water on both sides of the peninsula, has been a dominant factor in Delaware's well-known success in fruit and especially peach culture. The mean temperature during the summer months is 71. 9° with a maximum of 104°. The winter months are usually mild, having a mean temperature of 35° and a minimum of 10° below zero. The average date of the first killing frost in the fall is October 20 and the last in the spring is April 17, giving an average growing season of 186 days. The annual precipitation is reported as about 44 inches and is generally well distributed. Droughts are very rare.

Excellent water is found at a depth of from 15 to 30 feet.

There are 6,000 acres in the project and the price asked per acre is $25.

The work of reclamation would consist largely of drainage, clearing, addition to the soil of lime, phosphate, and nitrate of soda, and road-building. When fully developed, going-concern farms should not cost in excess of $125 per acre—a total of about $750,000.

Delaware was the first State to accept the Articles of Confederation of the United States. Since its first settlement, along about 1674, farming has been the chief occupation of the inhabitants of this region, so that its agriculture is quite highly developed and the lands under cultivation are close to markets. There can be no question about the soil and marketing facilities being eminently adapted to successful agriculture.

GEORGIA.

The investigations in Georgia have been made in cooperation with the committee appointed by Gov. Hugh M. Dorsey, consisting of Alex K. Sessoms, chairman, Cogdell; T. E. Phillips, Tifton; W. B. Roddenbery, Cairo; S. C. Townsend, St. Marys; J. J. Brown, Atlanta; F. H. Abbott, Waycross; Neal L. Gillis, Covena; C. S. Barrett, Union City; J. Phil Campbell, Athens; J. E. Bodenhamer, Decatur; Harvie Jordan, Monticello; W. A. Johnson, Savannah; J. B. Way, Thomasville; George B. Davis, Dublin; W. T. Staten, Valdosta; W. E. French, Valdosta; W. A. Charters, Gainesville; S. B.

Yow, Lavonia; J. B. Mills, Atlanta; A. J. Fleming, Atlanta; H. M. Stanley, Atlanta; Claude Bond, Toccoa; Josiah Blasingame, Jersey; and Lieut. J. A. Dew, Camp Gordon.

Thanks are also particularly due the Georgia Landowners' Association and its secretary, Mr. F. H. Abbott, for carrying out an extensive questionnaire program as well as helpful assistance in other ways, and to a good many local committees and chambers of commerce for an unexpected amount of thoughtful interest.

The total area figures for the State are:

	Acres.
Land	37,584,000
In crop	12,624,000
Unimproved in farms	15,000,000
Merchantable timber	5,000,000
Cut-over land	21,000,000
Swamp land	1,000,000
Overflow land	1,000,000
Periodically swampy land	700,000

Total number of farms, 330,000.

That is to say, about one-third of the land was in crop last year, nearly two-thirds in cut over, and relatively little in swamp—and 500,000 acres of that area in the famous Okefenokee Swamp in the southeastern corner of the State. Incidentally, this interesting and unique formation may never be drained—many Georgians of vision are urging that the best use of the basin would be as a reservoir to feed the high level of a Florida-Georgia ship canal from the Gulf of Mexico to the Atlantic Ocean.

Approximately speaking, the northern fifth of the country is mountainous or hill country from 1,000 to a maximum of 4,768 feet above sea level; the next third is Piedmont Plateau, from 500 to 1,000 feet elevation; and the remainder—about half—is coastal plain.

Undoubtedly in the Piedmont Plateau section can be found many attractive project opportunities, but no investigations were made in that part of the State, attention being concentrated upon the lower-lying lands of the coastal plain, where agricultural development is least advanced. There several areas admirably adapted for soldier-settlement colonies were examined and still others suggested.

The original forests of the lower-lying parts of the State consisted mainly of long-leaf pine, which has largely been removed. The remaining virgin timber is generally boxed for turpentine. The drainage channel "swamps" have a heavy growth of bay, gums, oaks, cypress, and black and slash pine, little of which has been cut over. It is in this region that most of the 21,000,000 acres of cut-over land is located and a small part of the cropped area. Large landholdings are very common. It is thus evident that there must be a wealth of project opportunities, even though only the smaller portions of the area may have soils particularly adapted to diversified agriculture.

The Suwanee project.—The Suwanee project is quite typical of the others examined—its selection for description must not be taken as inferring the possession of any especial advantages over the several other projects examined. It is located in the southeastern part of Georgia and comprises the eastern half of Clinch County, the west central portion of Ware County, and the southeastern tip of Coffee County. It lies wholly between two branches of the Atlantic Coast

Line Railroad, and has the Allalaha River for its extreme western boundary. Waycross, the county seat of Ware County, a city of about 20,000 people, is about 15 miles east of the eastern boundary.

The lay of the land is from extreme flat to gently rolling, with an elevation of from 100 to 150 feet above sea level approximately. The usual piney-woods sandy soils are present in the most part with clay subsoil. In 1906 the United States Bureau of Soils made a survey of the Waycross area. According to this, the Norfolk and Portsmouth soils are the predominating types of this area. Pine is the native timber. The principal crops are corn, cotton, sugar cane, sweet potatoes, and vegetables.

The climate is practically that of northern Florida, with winters mild and open, and long, hot summers. The mean summer temperature is 81° with a maximum of 105°, and the mean winter temperature is 51.3° with a minimum of 5°. Snow sometimes falls, but does not remain long on the ground. The average minimum winter temperature is 14°, the extreme of 5° having occured only once, 25 years ago. The maximum summer temperature rarely exceeds 100°, the heat, which otherwise would be excessive, being tempered by breezes from the Atlantic Ocean and the Gulf of Mexico. The average annual precipitation is 46.7 inches, and is exceptionally well distributed, being particularly adapted to promote the development of growing crops.

Ground water ordinarily stands 8 to 12 feet from the surface, but following severe rains when the soil is saturated, this level rises almost to the surface unless drainage is provided. Artesian water is available throughout this section at depths varying from 700 and 500 feet in the immediate area discussed to flowing wells found in the southeastern part of the State.

This land is owned in large tracts, two interests alone controlling over 300,000 acres. The average price per acre is quoted as $8.

The reclamation work would consist of extensive drainage, clearing, addition to the soil of lime, phosphate, nitrate of soda and humus, mospuito prevention, and road building. A 100,000-acre colony, completed, would cost not more than $10,000,000, or $100 per acre.

GEORGIA LANDOWNERS' ASSOCIATION (INC.),
Waycross, Ga., May 9, 1919.

Mr. H. T. CORY,
Consulting Engineer, United States Reclamation Service,
Washington, D. C.

DEAR SIR: You have furnished the members of the land settlement committee of the Georgia Council of Defense, appointed by Gov. Dorsey at the request of Secretary Lane, copies of the first draft of your proposed report on Georgia to Congress, with respect to the availability of certain of its lands for soldier settlement, and asked us to criticize the same and make a brief report supplementary thereto.

Your statement concerning the physical character and agricultural potentialities of the lands of Georgia's coastal plain section is most conservative—it errs on the score of conservatism if at all—and your recommendation for $10,000,000 for land settlement in the State is also most conservative. This can be shown quickly by simple mathematical deduction. An average of 50 acres to the farm on your estimate of $100 per acre for a prepared farm would call for only 2,000 farms. Several times this number of farms would be required by Georgia's returned soldiers alone, provided Dr. Mead's plan for modern, improved or ready-made farms in community settlements is followed, making farm life really attractive to the wives of these young men, as well as

providing a real business opportunity to the men themselves in an attractive social environment made possible by grouping 100 or more families together around a community center.

Your recommendation might be criticized, therefore, on the ground that the $10,000,000 appropriation suggested by you for Georgia is entirely too small to provide for the Georgia boys alone deserving farms whose service for the Nation demands that they have consideration at least equal to that accorded by Canada and England to their soldier sons.

We desire to tell you, also, that we have canvassed the situation with sufficient thoroughness in the State to assure you that the United States Reclamation Service and Congress can count on Georgia meeting them half-way and filling all requirements, either through the action of the general assembly or the action of private landowners.

In further support of your recommendation of $10,000,000 for Georgia you might have added that in every coastal plain county where lands have been offered, adequate railroad facilities are already at hand to carry farm products to present markets; that land clearing here is both quick and cheap; that drainage on by far the greater percentage of the land requiring drainage is comparatively quick, easy, and cheap; that while schools are not yet what they should be they are rapidly improving and there is an active public sentiment that assures at an early date a State-wide local tax law and a State-highway law; that the State has enacted a stringent tick eradication law which opens the way to profitable cattle industry; that the State already ranks fourth among the States in hog production; that five local packing plants distributed through the State provide ample live-stock markets; and that the adaptability of the soil to the raising of peanuts, sweet potatoes, velvet beans, and corn, and the long growing seasons, the cheapness of buildings for the protection of stock against bad weather combine to make the country particularly adaptable to live-stock farming, which is coming rapidly to the front.

Abundant opportunity for recreation and pleasure afforded through large and small game hunting, fishing, and ocean bathing at the near-by coast, makes this section especially attractive to the highest class of rural citizenship.

More could be said to fortify your statement that you examined "several areas admirable for soldier-settlement colonies," and to prove that your report and recommenadtion are sound and conservative.

For further and more definite knowledge as to the agricultural potentialities of coastal plain Georgia, we respectfully commend to you the motion pictures taken recently by Mr. J. C. Carter, official photographer of your service.

Yours, very truly,

ALEX K. SESSOMS,
Chairman Land Settlement Committee of
Georgia Council of Defense.

STATE COLLEGE OF AGRICULTURE AND MECHANIC ARTS,
UNIVERSITY OF GEORGIA,
Athens, Ga., May 1, 1919.

MR. F. H. ABBOTT,
Secretary Georgia Landowners' Association,
Wayeross, Ga.

MY DEAR SIR: I have read the draft of the report submitted by Mr. H. T. Cory, consulting engineer of the United States Reclamation Service, to the Georgia Land Settlement Committee for criticism. I can see no suggestion of any change which might with propriety be made therein except that I believe he should include potash in the list of essential plant foods which could be used in certain of the soil types he describes, especially with truck crops, to advantage. I speak, of course, of the use of potash when it may be made available in considerable quantities and at a cost approximating that prevailing in prewar times.

I have read the revised or amended copy as prepared by you and your associates. I fully subscribe to the changes you have made therein. I think it is essential that these changes be indicated in some such manner as you have suggested or an injustice would be done the section of the State concerned. I presume Mr. Cory is a very reasonable and liberal man and will be glad to consent to these amendments in his report.

With best wishes, I am,

Very respectfully,

ANDREW M. SOULE, *President.*

FLORIDA.

The investigations in Florida were carried out in cooperation with the Florida tick eradication committee, Dr. W. F. Blackman, manager, and the official State committee appointed by Gov. Catts composed of W. H. Coachman, chairman, Jacksonville; R. W. Stoors, Jacksonville; and Jules M. Burguieres, West Palm Beach.

The total area figures for the State are:

	Acres.
Land	35,100,000
In crop	1,560,000
Unimproved in farms	3,500,000
Merchantable timber	10,000,000
Cut-over land	12,500,000
Swamp land	18,000,000
Overflow land	1,000,000
Periodical swamp land	800,000

Total number of farms, 70,000.

Thus, Florida had last season but 4½ per cent of its land in crop and less than three times the cropped area in tiny Delaware.

The entire State is coastal plain, low, and flat, though rolling in many portions of the interior. The highest point is but 327 feet above sea level, and the average but 100 feet.

The southern end is largely the Everglades, which has a maximum elevation of 24 feet. Lake Okeechobee, with a high-water surface of 500,000 acres, has a range of between 13 and 22 feet above mean tide, and the control of this body of water is practically synonymous with reclaiming nearly 5,000,000 acres. The State of Florida owns here 1,200,000 acres. The works required, though involving several million dollars in cost, are not complex from an engineering point of view, but navigation as well as drainage is involved. Much essential work is well under way and much has been completed.

Obviously, then, the Everglades at once attract attention. The numerous holdings of the State and a very few interests make the blocking out of even half-million-acre projects relatively easy.

But Florida with its enormous extent of undeveloped land offers many other attractive project opportunities—after eliminating vast areas which are ill-adapted to ordinary types of agriculture and rightly should be kept in timber. A number of citrus fruit colonies like those in southern California, cattle-ranch colonies, truck gardening—including de-hydration—colonies, dairying colonies, and diversified farming colonies are all easily possible.

Because of such a wealth of project opportunities of many types from which to choose, the need for considering the State's ideas in making a final selection of a project or projects is in Florida peculiarly great. Fortunately the Florida Legislature in special session enacted legislation in the premises, and the Commonwealth has duly authorized the committee hereinbefore mentioned to represent it in the matter.

Since to many people the soldier-settlement opportunities in Florida are synonymous with the Everglades and citrus fruit lands, three of the many project opportunities in this State will be described—one in the Everglades, one diversified farming, and one dairying. In addition to these, it must not be forgotten that the

southern part of the Brewton project described under the heading "Alabama," lies in Florida.

The Everglades project.—The Everglades project is limited in size only by the money availably for it. The State of Florida would gladly "block up" its lands with other owners and join with the United States in developing nearly, if not indeed all, its 1,200,000 acres in the region. A colony under 300,000 acres in size could be located in many parts of the "Glades." Perhaps as advantageous a selection as any would be between West Palm Beach and Lake Okeechobee as shown on the map. Palm Beach and West Palm Beach, practically one city, are world famous winter resorts with a summer population of about 2,000 and are on the main line of the Florida East Coast Railway from Key West to Jacksonville. A branch of the same railroad runs from the north to Okeechobee. These, with an asphalt surface highway built west from Palm Beach, and the navigable canals constitute the transportation facilities.

The Everglades project would consist wholly of an almost perfectly level prairie area normally covered by a very thin sheet of water and "saw grass." The United States Bureau of Soils has made no soil surveys in the Everglades except that of the Fort Lauderdale area in 1915, but numerous others have. While considerable difference of opinion exists as to the permanent fertility of the "saw grass" land, there can be no doubt of the initial fertility which is amply demonstrated in many places. The enthusiastic faith in such soil of many people is being backed up by large expenditures on capital account throughout the region. A good many of the heaviest investors expect the Everglades will in a few years practically take care of the Nation's present consumption of sugar and make it self-sustaining in subtropical products. On the other hand, not a few "view with alarm" agricultural development endeavors and expect future failure. The State officials of Florida stand firmly in the first class.

The climate is subtropical yet peculiarly equable. The mean temperature during the summer months is 81° or 82° with a maximum of 96°. The winter months have a temperature averaging about 67° with a minimum of 25°. It has been demonstrated that the more an area is drained the lower its temperature will be. The annual rainfall is well distributed and abundant, about 61 inches, being heaviest during the summer months and lightest after the 1st of October. The average date of the first killing frost is December 29 and the last one of the season February 7, which gives a growing season of about 315 days. The whole area, being low and flat, is continually swept by breezes from the Atlantic Ocean and the Gulf and is close enough to the beach for surf bathing to be an added attraction. An abundant water supply can be had from (shallow) artesian wells, which, though having a sulphurous taste, is good in all other respects.

The reclamation work would consist in drainage, clearing away saw grass and preparing the seed bed, road building, and mosquito prevention.

Going-concern farms would certainly cost not to exceed $100 per acre, hence a 100,000-acre colony would cost not in excess of $10,000,000, and colonies of different sizes in like proportion.

The Aripeka project.—As a sample of a diversified farm colony the Aripeka project will be taken. This project is located about 30 miles north of Tampa and comprises the southwest portion of Hernando and northwest portion of Pasco Counties, fronting 15 miles on the Gulf of Mexico and extending eastward an extreme of 20 miles. The county seat of Hernando County—Brooksville, a little city of about 1,000 inhabitants—is just outside the northeast corner. The Tampa Northern Railroad, from Tampa to Brooksville, runs through the heart of it, and the Atlantic Coast Line Railroad skirts the tract on the south and east. The Dixie Highway, an improved road from Tampa, traverses the coast to Aripeka, where it begins to swing inland to Brooksville.

The lay of this land is quite variable, shifting from level to rolling. The northwestern portion rises high and dry a hundred feet above sea level, needing no drainage at all, while the southeast is flat woods with ground water close to the surface or above it.

The intermediate country is beautifully smooth, piney-woods plains, with just enough slope for good drainage and convenient mechanical tillage. Along the coast is a strip of cabbage palmetto land slightly above tidewater, while in the southwest the cypress ponds break up the landscape and present material difficulty from an agricultural standpoint. Around Brooksville there is a section of distinctly hilly country, some of the hills rising 200 to 300 feet in height.

The soil, like the topography, is variable, but practically all of it would make good farms, being the gray-brown or lighter sandy loam in the uplands, with somewhat heavier to mucky soils in the prairies and hammocks. The flat-woods soil runs from gray to white sand and is less fertile. Clay subsoil is general, yellow, or brown sandy subsoil to a considerable depth in places, with marl or rock through the coast areas. In 1914 the United States Bureau of Soils made a soil survey of Hernando County.

In general, the yellow timber has been cut off and second growth has been and still is being turpentined to a considerable extent. The hammocks and swamps show a strong growth of hardwoods and cypress, denoting good soil. Clearing would be of average cost for cut-over country.

Immediately around Brooksville and northeastward of the project generally is an established farming country of many years' development. Staple crops, such as oats, corn, cotton, potatoes, sugar-cane, and other products, yield well, added to which every farmer has his oranges. A recent specialty on high, sandy, pine-ridge land is the Natal grass, which cuts two or more crops per season and makes a hay that sells for timothy price.

This region has a subtropic though pleasant climate, with a mean temperature during the summer months of 81° and a maximum of 102°. The mean temperature for the winter months is 60° and the minimum temperature 16°. The winters are mild, with only an occasional cold spell of short duration. The annual precipitation is about 56 inches and is heaviest during the summer months. December 21 is the average date of the first killing frost and February 13 the last, leaving a growing season of 311 days.

Good well water is to be had at varying depths throughout the section, and while the country rock is a sort of limestone, the water

is usually soft and more agreeable to the taste than the artesian water in some parts of the State.

The land is owned in relatively large tracts, there being seven principal owners in the 150,000 acres now under discussion. This land has been offered at an average price of $7.50 per acre.

The reclamation work would consist of drainage, clearing, addition to the soil of phosphate, nitrates, and lime, and road building. One of the very important advantages of this section is the good road material found in widespread lime-rock deposits. The land when reclaimed should cost not to exceed $100 per acre, hence not more than $10,000,000 for a colony of 100,000 acres.

The Duval project.—The Duval project, peculiarly adapted for dairying, is about 20 miles southwest of Jacksonville, and comprises the southwest portion of Duval County. Being just a little south of Baldwin, a junction station of the Seaboard Air Line Railroad, with a main line of railroad along the north edge, another through the west portion, and tide water only 7 miles from the southeast corner, the tract's transportation facilities are very good.

This project, situated on the watershed between St. Marys and St. Johns Rivers, is flat with a summit elevation of about 90 feet above sea level. The soil consists of fine sand and sandy loam, with a clay subsoil as a rule. The average sandy loam of the tract seems to be of good quality for the usual southern crops. Though the timber has long since been cut off, there still remains a sparse growth of small pine of the flat lands. The usual native grasses appear in average abundance. While this region makes a specialty of hog raising, oats, corn, cotton, and other staple southern crops can be raised. The United States Bureau of Soils in 1910 made a soil survey covering the project.

The climate here is practically subtropical, with a range in temperature of 81° and mean winter temperature of about 62°. The average dates of the first and last killing frosts, respectively, are November 12 and April 6, which gives a growing season of 220 days. The average precipitation is reported as 51½ inches annually, or about 45 to 70 inches extremes. On the whole, the climate is quite pleasant and healthful.

Good domestic water is obtainable from deep bored wells, but even ordinary wells bored at shallow depths yield satisfactory water for domestic purposes.

Land is held in large tracts, three interests alone controlling 46,000 acres.

The price per acre is $8.

The work of reclamation would consist of drainage, irrigation, clearing, addition to the soil of phosphate, lime and nitrates, and road building.

Completed, the land would not cost more than $100 per acre for any project of 30,000 acres or larger.

Milk and butter production is an inviting field in this locality. Not only is this region eminently adapted for the establishment of dairying, but with Jacksonville as a market the commercial advantages would be most significant. This large and growing city has no adequate dairy development near by and is but poorly supplied with milk, while butter comes from far away. The ice-cream

industry in the summer is of large proportions. The Duval project is one of the best opportunities for dairying in the southeastern part of the Nation.

FLORIDA CATTLE TICK ERADICATION COMMITTEE,
Jacksonville, Fla., May 13, 1919.

Mr. H. T. CORY,
Consulting Engineer, Reclamation Service, Washington, D. C.

DEAR MR. CORY: Your report on Florida bearing on Secretary Lane's soldier-settlement plan has been read by the members of the committee appointed by Gov. Catts and the officers of the Florida Cattle Tick Eradication Committee, which cooperated with you at your request in the inspection of lands in this State available for such settlements. They all heartily approve of the report in the main. We are of the opinion that your statements are conservative—perhaps on the whole unduly so—and they can be abundantly substantiated. We venture, however, to offer two suggestions by way of amendment:

1. The schedule of areas which you give on your first page seems to us in one important particular to be misleading. The word "swamp" may be variously defined and understood, but it is certainly not true that more than half the land area in Florida is "swamp" in any sense in which that word is commonly used, or, indeed, in any sense whatever. In a subsequent paragraph you will find an analysis of the land area of the State, which is furnished and vouched for by the State geologist and which may be regarded as approximately correct.

2. In your discussion of the Everglades, Aripeka, and Duval projects you give the date of the first killing frost in these several regions and the length of the growing season, but have you not overlooked the very important fact that statements regarding this matter which would be fully justified as applied to more northern latitudes have no proper application in Florida? In the North the first killing frost definitely puts an end to the growing season, which does not begin until spring; in Florida a frost may occur in November or December and within a week or two thereafter grasses and vegetables may, and often or generally do, begin growing again. That is to say, a frost here is only a temporary and not a permanent interruption of growth. Many of our famous truck crops are made and marketed during the period in which, according to the statements of your report, no growth occurs. It is not quite exact to say, as we often do, that in south Florida the growing season covers the 365 days of the year, but this statement is nearer the truth than that the growing season covers 220 days in Duval County, 311 days in Hernando County, and 315 days in Palm Beach and Dade Counties.

According to estimates furnished by the State geologist, based on published soil maps, county maps showing vegetation types and various reports of the Geological Survey, Florida contains some 6,000 square miles of muck lands, 6,500 square miles of prairie lands, 18,000 or 19,000 square miles of flatwoods, 13,500 square miles of high pine lands) nearly 6,000 square miles of high, middle and low hummocks, 1,000 square miles of scrub lands, and 2,800 square miles of swamps.

The muck lands are located mostly in the Everglades, but very considerable areas are scattered over the State. These muck soils are generally of great depth and extraordinary fertility. Some of them are covered always, or in rainy seasons, with a shoal sheet of water; some of them are dry and arable; practically all of them may be drained with comparative ease; and they are specially suited to the growing of sugar cane and the various grasses, though they are also well adapted to many forage and vegetable crops. When drained, cleared of inferior grasses and weeds and set to Bermuda, Giant Bermuda, Para, Carib, Joint, and other improved grasses, they are capable of carrying a vast number of cattle and other live stock; I should say they could support at least one head of cattle to the acre the year through.

Prairies are found in all parts of the State, but the largest areas are in the upper St. Johns, the Kissimmee, and the Caloosahatchee Rivers in south Florida. These prairies are without trees, except for the clumps of cypress, cabbage palmettos, and other growths which dot them here and there with "islands" which furnish shade for cattle and food for swine, and are bordered by open or saw palmetto flatwoods and dense hardwood hummocks. The soil

varies from light sandy loam to muck, or—along the rivers—a deep, black, rich alluvial deposit. They are covered with nutritious native grasses and are now carrying summer and winter, as they have carried for immemorial times, large herds of cattle, many swine, and a few thriving flocks of sheep. On a considerable part of these prairie lands flowing wells can be driven, furnishing an abundant and inexhaustable supply of pure water, and on all of them it is possible by the use of windmills or gasoline engines to obtain water at slight expense. Some of these prairies need to be ditched for the carrying off of surplus water during the rainy season, and those which border the rivers are subject to occasional overflow. When these prairies are fenced and planted in improved grasses, there are no better pastures anywhere.

The flatwoods, perhaps ten or twelve million acres, are distributed rather evenly throughout the State. They vary greatly in soil, subsoil, elevation, and conditions of moisture and overflow. Some of them are "open flatwoods," while some are covered with a more or less dense growth of saw palmetto. For the most part, they carry a rather heavy growth of wire grass, though where fires have been controlled carpet grass, maiden cane, various paspalums, and numerous other nutritious grasses are found in fair abundance. Practically all of these lands, if properly managed, will carry Bermuda, Joint grass, Napier grass, Rhodes grass, and beggar weed, and in the more southern latitudes, Para, Carib, and Guinea grass. Such forage crops as corn, the sorghums, Japanese cane, the millets, the numerous varieties of cowpeas, oats, rye, vetch, cassava, and many more do well in these lands, so that it is possible to carry on them any necessary quantity of hay and other feedstuffs for supplementing the pastures during the two months of winter when these are at their poorest.

Perhaps nothing need be said for the purposes of this report concerning the high pine lands and the hardwood hummocks of the State.

Florida is fortunate in having a climate which makes it possible to graze live stock practically the year around. Expensive barns and other shelters are unnecessary and three crops can be grown annually in succession in all cultivated fields. Severe and protracted droughts are almost unknown. There is a copious and well-distributed rainfall, and countless lakes, rivers, creeks, springs, and flowing wells furnish unfailing supply of water almost everywhere. The diseases and predatory animals which affect the live-stock industry unfavorably in many sections of the country are for the most part lacking here. The cattle-fever tick will be practically eliminated from the State within the next two or three years, and the way will be opened for the introduction of good breeding stock from the tick-free areas of the North, the development of pure-grade and high-bred herds, and the free and profitable marketing of our products. Also hogs, sheep, and goats do well in all parts of the State.

The committee recommends that if one or more colonies for returning soldiers are established in Florida, they should be devoted in the main to the production of live stock and to the dairy industry.

Finally we would emphasize the fact that the three projects described in your report are merely samples of a very large number of possible projects, equally adapted to the purpose, or in some cases perhaps even better, which are available in this State. As to the particular area to be selected, we should wish to reserve judgment.

FLORIDA CATTLE TICK ERADICATION COMMITTEE.
By W. F. BLACKMAN, *Manager.*

SUPPLEMENTARY REPORT OF THE AGRICULTURAL COLLEGE AND EXPERIMENT STATION.

UNIVERSITY OF FLORIDA,
COLLEGE OF AGRICULTURE,
Gainesville, May 16, 1919.

Mr. H. T. CORY,
Consulting Engineer, Reclamation Service,
Washington, D. C.

MY DEAR MR. CORY: I have before me a letter from W. F. Blackman, manager of the Florida cattle-tick eradication committee, inclosing a paper giving a discussion of your investigations in the State of Florida with regard to the Everglades project, the Aripeka project, and the Duval project. In the main the dean of the agricultural college and director of the experiment station approves

of the report, also the supplementary report of the committee. Your report is conservative, and if it errs it is in the direction of being too conservative.

By way of amendment to your report allow me to make the following suggestions:

(1) In the first paragraph below the table you place the area in cultivation at 4½ per cent. I am told that the last Federal census gives the area in cultivation at 15 per cent. In that same connection it would be well to call attention to the fact that the cultivated area in Florida yields more dollars' worth of farm products per acre than is obtained anywhere else in the United States.

(2) On a subsequent page, under Aripeka project, you mention the city of Brooksville as having about 1,000 inhabitants. Apparently this city had 1,385 inhabitants in 1915.

(3) On a later page, under the same project, in discussing the water you say "the country rock is a sort of limestone." I believe geologists classify this as Vicksburg limestone.

(4) The above emendations can easily be made, and should be corrected, as the statement will be repeatedly used on the authority of "Government publication."

(5) The cattle-tick eradication committee has already called attention to the use of the term "swamp land," also regarding the average date of the earliest frost in the fall and the latest in the spring. This should not be taken in the sense in which it is used in your paper, since there are many vegetables and farm crops that are not affected by the earliest frost. I need only to mention such crops as oats, rye, barley, and a considerable number of grasses, as well as cabbage, cauliflower, celery, and other important vegetables. The growing season of many crops is not terminated by the occurrence of frost.

The Florida projects.—The paper discusses only three projects: The Everglades project, the Aripeka project, and the Duval project. Each one of these three projects is excellent and has many points in its favor. The question as to which one of the three would be best would depend entirely upon the desires and ambitions of those who are furthering the project. In addition to those named, there are doubtless a score of other projects equally as meritorious for the purposes of this work.

The report has well said that "to many people, soldier settlement opportunities in Florida are synonymous with the Everglades and citrus fruit land." This is due to the fact that the citrus fruit production and Everglade lands have been very largely advertised throughout the United States. This is something different from what most of the Southern States have to advertise, and hence special stress has been laid upon it. It should not be forgotten. however, that diversified agriculture and stock raising are most important and to-day claim the attention of more people in the State and produce more wealth for the State than is produced by the citrus crop. This is no disparagement for the citrus crop, but a plain statement of fact. The citrus crop is undoubtedly the most alluring and attractive. General farming and stock raising, including swine raising, have come forward in Florida by leaps and bounds—especially is this true of hog raising. In the last 10 years the hog industry in the State of Florida has increased by 85.7 per cent, exceeding in rate of increase in the last 10 years all the other Southern States. In this connection it should be remembered that the 15 Southeastern States now contain 33 per cent of the total hog population of the United States, showing a most remarkable increase in the last 10 years. Any one of the three projects mentioned can be profitably utilized for pork production. This is no longer an experiment, but an established fact, though it is not generally known outside of the State of Florida. Poultry raising is also coming to the front, and live stock raising has made most rapid strides in the last 10 years

The production of forage crops in Florida can be carried out with greater ease than almost anywhere else in the United States. We have a greater wealth of crops to choose from and a much longer growing season, thus reducing very materially the period during which it is advisable, though not absolutely necessary, to maintain the herd on harvested crops. The velvet bean, which is grown on millions of acres in the South, is not yet appreciated by any outside of our borders. The great number of tropical grasses available to us, such as Napier grass, Merker grass, Japanese sugar cane, Rhodes grass, Natal grass, Para grass, Carib grass, and Guinea grass are as yet insufficiently appreciated. This is due to the fact that most people are not familiar with these crops, and fail to recognize the fact that Florida is subtropical and lends itself more readily to the production of tropical and semitropical crops than it does crops

from the temperate regions. By proper adjustment and succession of crops, it is unnecessary to carry in storage on the farm any large quantity of hay or other maintenance crops for stock. Bermuda grass, so much despised by the cotton grower, is the best basis for permanent pasture we have found on the general farm. Its persistence and aggressiveness make it most useful in this direction and its high nutritive value makes it a strong competitor of blue grass.

With each succeeding year the production of vegetables is becoming more greatly specialized and stabilized. It is becoming more and more the practice by the general farmer to grow some truck crops for the early market. This enables him to have an income at a time of year when general farm crops are not being sold, and also to utilize the labor when it is not absolutely necessary to employ it for the general farm crops.

It is not generally known how greatly the farm crops in Florida have increased in value during the last 10 years. The total value of the 12 leading farm crops sold in 1918, excluding cotton, citrus, and truck, was nearly six times the value of those crops in 1910.

Everywhere in the State good, pure water of the most healthful kind can be found in unlimited quantities. In a large portion of the State flowing artesian wells may be obtained. The water given forth by these wells is usually sulphurous as it comes out, but on standing or aerating the sulphurous odor is lost completely. It makes the best kind of water for household purposes and for live stock on the farm. There is practically no place in the agricultural region of Florida where water is difficult to obtain.

Large regions may be obtained where no forest growth occurs and only a small amount of ditching is necessary to remove the surplus water and have the land in good condition to begin farming operations.

The so-called prairie regions may be brought into agricultural condition by a small outlay of money for drainage purposes. The drainage work in the Everglades is so well understood that it needs only to be mentioned that much of the Everglades land is already being cropped, and new areas in the Everglades are being opened up every year. A large diversity of crops can be grown in this region, sugar cane being among the most promising and profitable.

Very truly, yours,

P. H. Rolfs,
Dean of the Agricultural College and Director of the Experiment Station.

KENTUCKY.

Gov. Augustus O. Stanley on March 8, 1919, appointed a committee of five to represent the Commonwealth of Kentucky in the soldier-settlement matter, consisting of Dr. Frank L. McVey, chairman, Lexington; Harvey Chenault, Richmond; Owsley Brown, Louisville; W. A. Wickless, Greenville; and W. F. Bradshaw, Paducah.

Investigations in the State were made prior to the appointment of the committee.

The total area figures for Kentucky are:

	Acres.
Land	25,715,500
In crop	6,925,000
Unimproved in farms	8,000,000
Merchantable timber	6,300,000
Cut-over	3,250,000
Swamp land	0
Wet grazing land	100,000
Overflow land	300,000
Periodical swamp land	45,000

Total number of farms, 270,000.

While the crop acreage last year was not quite 7,000,000, the improved farm land is usually given as about exactly twice that figure.

At any rate, much of the State is highly developed agriculturally and the areas of cut-over and wet lands, especially the latter, are relatively small.

Roughly speaking, the southeastern quarter of the State is mountain and hill land, from elevations of 900 to 4,100 feet above sea level, and about one-sixth along the Ohio River below Cincinnati is below the 500-foot contour.

Because of the agricultural developments in various parts of the Commonwealth, the most obvious places to seek soldier-settlement opportunities are in the low-lying lands in the western end and the higher land in the southeastern corner. The central blue-grass region is far famed for its high development and high prices of farms.

The project opportunities in the west are small, 20,000 acres and under, and are adapted to diversified agriculture. Such settlement would be essentially similar to the proposed colonies in most of the other States in the southern district except as to size.

The projects in the southeastern corner would be quite different and have a counterpart in West Virginia only. That is to say, the soldier settlements would be of a distinctive type and feature sheep and yearling-cattle production. They would, in consequence, be the most interesting projects from a sociological point of view in perhaps the entire Nation.

Diversified crop colonies.—The climate in western Kentucky is slightly warmer than that in the eastern section. The summer months have an average temperature of between 75° and 80°, while winter months have a mean temperature of about 35°. The average date of the first killing frost is between October 15 and 20, and the last killing frost is about April 17, leaving a growing season of about 190 days. The average annual precipitation is from 45 to 50 inches and rather more evenly distributed than is that of the eastern section. The whole State has years of excessive rainfall and then again years that are decidedly droughty.

The price of these colony lands would be about $30 an acre.

The reclamation work would consist of drainage work, clearing, liming the soil, preparing seed beds, and road building. When completed the cost of the farms would be about the same as in other southern colonies of like nature.

Stock-producing colonies.—The hill country of Kentucky, where of limestone formation, is a blue-grass region. Except for small scattered areas the land is too rough for cultivation and the development is very backward. Land values are especially low where mineral and coal rights are reserved by the seller, and ownerships fairly large. The acquiring of only surface rights for colonies is not objectionable—there is no particular reason for speculative possibilities concerning subsurface values in allotments.

Many people would prefer "horseback agriculture," to any other kind if sociological features were satisfactory and if they could live in a planned community, marketing very little but live stock, yet laid out and designed in all details to secure sufficient social advantages, comforts, conveniences, and attractions.

There seem to be numerous project opportunities for this type of a colony in eastern and southeastern Kentucky and of widely varying

size. The profitable outlining of any one project can hardly be done until the amount of money available be known. The Kentucky committee indicates the section of the State where such project opportunities are mostly located as shown on the map.

The mean temperature for the summer months in the eastern part of the State ranges from 71 to 77° with a maximum of about 100°. Of the winter months, the mean temperature is between 32 and 39°, with rather frequent drops to below zero, 20° below having been registered once or twice within the last 45 years. The average date of the first killing frost in the fall is between October 13 and 25, and the last in the spring is between April 15 and 20, thus giving an average growing season of from 177 to 190 days. The annual precipitation shows a wide variation for the individual months, seasons, and years. The average rainfall is, however, somewhere between 40 and 50 inches.

The price of the land, sometimes surface rights only, would range from $2 to $10 per acre.

The reclamation work would consist largely of developing cultivable acreages on each allotment, so far as practicable, for producing feed to carry the stock over the winter months. This would mean clearing, some drainage work, preparation of seed beds, etc. In addition to this would be clearing underbrush and pasturage improvement, road building, etc.

The cost expressed upon an acreage basis of going-concern farms in such a project would be about two-thirds as great per acre as in cut-over land and drainage projects in the other Southern States. A much smaller proportion of the investment, however, would be in improved land and more in live stock. One hundred and forty thousand acres of such settlements would thus cost about $10,000,000.

LEXINGTON, KY., *May 18, 1919.*

Dr. H. T. CORY,
Consulting Engineer Reclamation Service,
Department of the Interior, Washington, D. C.:

Committee has gone over material which you sent me and find it approximately correct. I presume you have copy for your committee.

FRANK L. MCVEY.

UNIVERSITY OF KENTUCKY,
COLLEGE OF AGRICULTURE,
Lexington, Ky., June 25, 1919.

President F. L. MCVEY,
University of Kentucky, Lexington, Ky.

MY DEAR PRESIDENT MCVEY: I herewith return the material and report to which Mr. Cory refers.

Prof. Roberts will not return until Sunday. Therefore, I have checked the figures and discussed the general statement with Prof. Kinney. I present the following figures as taken from the census of 1910.

	Acres.
Approximate land area	25,715,840
Land in farms	22,189,127
Improved land in farms	14,354,471
Woodland in farms	6,951,626
Total wooded area (Barton's report)	9,400,000

Cut-over land, practically entire area.
Total number of farms, 259,185.

The woodland acreage, 9,400,000, was obtained from Mr. Barton, forester for the State of Kentucky. Personally, I think this is high by some millions of acres, as the figure is very close to the difference between the improved land in farms and the approximate land area of the State.

I am unable to obtain any authoritative information as to the acreage of cut-over land, merchantable timber, swamp land, etc. I presume the estimates given are as fair as any other estimates that may be made. It seems to me that it makes very little difference whether the actual acreage of overflow land is 300,000 or 600,000. The fact of the matter is it depends entirely upon the season, the rise of the river, etc.

The area given for merchantable timber is undoubtedly too high, provided they use the term as we ordinarily mean it. If, on the contrary, the term is applied to any area from which the timber may be taken off for the purpose of sale, I presume it may be correct, as even in the blue grass we have trees here and there on farms that may be marketed.

The original statement covering the possibilities of soldier settlements appears to me to be a matter of opinion. I do not care to express myself until we have rather definite information as to what is intended and what may be required. Prof. Kinney also considers the statement to be one of opinion and does not desire to make a statement with the present information.

Very truly, yours,

THOMAS P. COOPER,
Dean and Director.

LOUISIANA.

Investigations in Louisiana have been carried out in cooperation with the committee appointed by Gov. Ruffin G. Pleasants, consisting of E. E. Lafaye, chairman, New Orleans; H. B. Bayliss, Lake Charles; Harry P. Gamble, New Orleans; and W. R. Dodson, Baton Rouge.

The total area figures for the State are:

	Acres.
Land	29,062,000
In crop	4,980,000
Unimproved in farms	5,000,000
Merchantable timber	2,250,000
Cut-over lands	12,000,000
Swamp lands	9,000,000
Overflow lands	1,196,000

Total number of farms, 123,000.

Thus over one-third of the State is wet land, nearly a half cut-over land, and only one-sixth in crop last year.

The highest point in Louisiana, in the northeastern part, is only 400 feet above sea level; the average for the State is only 100 feet, and two-thirds of it lies below the 100-foot contour.

There is thus to be seen a considerable similarity between this State and Florida in this, that there are vast acreages of both low-lying cut-over lands and wet lands. Further, the wealth of project opportunities is almost embarrassing. Over 5,000,000 acres were offered in response to questionnaires and 2,800,000 acres inspected. Even so, no doubt many additional offerings will be made on widely published notice of our being able to deal on a definite basis.

Selection must be made of a wet-lands project or a cut-over lands project or two projects taken—one of each type. One of each class of project will be described simply as indicative of Louisiana's enormous soldier settlement opportunities.

The Lake Charles project.—This project lies in the northern part of Calcasieu, the southwestern part of Beauregard, the northwestern corner of Jefferson, and the western part of Allen Parishes, with its center just 5 miles from Lake Charles, a city of 17,000 inhabitants. The Houston and Calcasieu Rivers and their tributaries drain the western and east-central parts of the tract, respectively. Four lines of railroad run through the property—the Kansas City Southern through the western part, the Lake Charles northern branch of the Southern Pacific through the central, the Iron Mountain through the eastern, and the St. Louis & San Francisco across the northern part. The first three have Lake Charles for their terminal point.

In 1901 the United States Bureau of Soils made a survey of the Lake Charles area, and essential agricultural data concerning the project are therefore at hand. This area is gently rolling, with an elevation of from 30 to 50 feet above sea level. The soil is a fine sandy loam of the Susquehanna type, from 2½ to 3 feet in depth. This soil is excellent for raising rice, although corn, cotton, oats, potatoes, hay crops, and others are beginning to be very profitably raised. The native timber is the long-leaf pine, but the entire area has been cut over.

The climate of this region is temperate, thanks to the moderating influence of the Gulf and the many lakes and streams. The mean temperature for the summer months is 80.8°, with a maximum of 101°. The mean temperature for the winter months is 52.6°, with a minimum of 10°. The average dates of the first and last killing frosts are November 25 and February 24, respectively, giving an average growing season of 274 days. The average annual precipitation is recorded at about 55 inches and is heaviest during the winter months and in May, June, and July. Damaging storms are rare.

Excellent water in abundant quantities for domestic purposes is found at a depth of from 100 to 150 feet. The depth to artesian flow is from 650 to 700 feet.

The land is owned in large blocks, there being but seven interests represented in the tract of 90,000 acres under discussion. This land can be had at a cost of about $10 per acre.

The reclamation work would consist of a comprehensive drainage system, some clearing, addition of lime, etc., to the soil to sweeten acidity, preparation of seed beds, mosquito prevention, and road building. The cost of completed farms would be about $100 per acre.

The Natalbany project.—This project is located in Tangipahoa, Livingston, and St. Helena Parishes, about 20 miles from Hammond, La., a progressive town of about 5,000 inhabitants. While these lands are not on the main lines of any railroads, they are close to the main line of the Illinois Central, whose stations can easily be reached by short distances of good roads. The New Orleans, Natalbany & Natchez Railroad, running through the center, is the logging line of the project and handles freight for the Illinois Central under special contract. Three rivers of permanent flow drain this area: The Amite, the Tickfaw, and the Tangipahoa.

The topography is from level to gently rolling, at an elevation of from 150 to 200 feet above sea level. In 1904 the United States Bureau of Soils made a survey of the Tangipahoa Parish and in 1912 such a survey of the Feliciana Parish, which adjoins the St. Helena

and Livingston Parishes, was made. The soil is chiefly a sandy loam underlain with a clay subsoil. Cotton, corn, sugar cane, potatoes, strawberries, and all kinds of garden truck are raised. The native timber consists of both long and short leaf pine. There are extensive live-stock operations in the vicinity.

The summers in this region are long and hot, but are tempered by the gulf breeze. The average summer temperature is about 84°, and seldom gets above 95°. The average winter temperature is about 53°, with a minimum seldom below 18°. The absolute extremes are reported by the weather bureau at Hammond as being 1 and 106°. Killing frosts are not expected before November 11 or after March 2, thus giving an average growing season of 254 days. The average annual rainfall is about 55 inches and is well distributed. The summer is the wettest season and the falls are dry. Abundant water of good quality can be found at a depth of from 30 to 40 feet, and artesion flow from 900 to 1,200 feet.

The tract of 100,000 acres is owned by one company and can be bought for $10 per acre.

The reclamation work would consist of drainage, land clearing, mosquito prevention, road-building, and the addition to the soil of phosphate, nitrate of soda, and potash.

MARYLAND.

The committee representing the State of Maryland in the soldier settlement program was the agricultural subcommittee of the Maryland Council of Defense until superseded May 28, 1919, by a committee appointed by Gov. Harrington, consisting of the following: John F. Dennis, chairman, Baltimore; Clement S. Ucker, Baltimore; Phillip Lee Goldsborough, Baltimore; Dr. A. F. Woods, president Maryland State College of Agriculture, College Park; Senator W. J. Frere, Tomkinsville; William McKenney, and Samuel L. Burn.

The total land data for the State are:

	Acres.
Land	6,362,240
In crop	2,250,000
Unimproved in farm	1,700,000
Merchantable timber	375,000
Cut-over land	1,900,000
Swamp land	100,000
Overflow land	92,000

Total number of farms, 50,000.

The improved farm area is given as half more than the land cropped last year, or a little more than half the total land area. A little less than one-third is cut-over and but 3 per cent wet land.

Except as to the small amount of wet lands, these figures do not, however, tell the whole story. Generally speaking, Maryland is a State quite highly developed agriculturally, but nevertheless on both sides of Chesapeake Bay there are wide fringes of mostly "abandoned" lands—lands which have been neglected and let go back since the Civil War. As Mr. Clement S. Ucker, of Baltimore, expresses it, they need four L's: Lime, legumes, live stock, and local

option. In the southern bay districts only small scattered farms seem to have enjoyed the benefit of more than the last item.

It is a very striking fact that lands which until 1870 had been for two centuries highly regarded for agricultural purposes, which lie almost within sight of the Nation's Capital, and which are within motoring distance of over a million and a quarter urban population, should be selling at from $10 to $20 per acre.

In this region there are not a few "silent" churches—eloquent monuments to and forceful reminders of the serious retrogression in this country's development. Most of them are quite old, large brick structures indicative of highly prosperous communities.

But improvident agriculture, dearth of man power after the war, and the lure of the city and of the West are the obvious causes of the existing condition of affairs. No less obvious are the things required for rehabilitation. In general the cost will be less and the time required but little more to "bring back" such land than to reclaim arid and wet areas often far from markets and large urban centers.

There is very little wet land, relatively speaking, and most of the cut-over and inferior timber land is in fact this "abandoned" land. Hence by far the most attractive opportunities for soldier settlements in Maryland are to be found in fairly small projects—under 20,000 acres—blocked up largely from nonresident holdings in the Chesapeake Bay counties.

There are a few swamp-land project possibilities. Generally they are long and narrow in shape and would naturally best be made parts of "abandoned" land areas. An exception is that part of the Cypress project described under "Delaware" which lies in Maryland and the greater part of which area should be included therein.

The Waldorf project.—As illustrative of what is meant and also because most of the lands in the project are now in one ownership, the Waldorf project will be described. It is situated in Prince Georges and Charles Counties and is but 25 miles from Washington. It is traversed by the Popes Creek branch of the Pennsylvania Railroad and Waldorf Station is 6 miles beyond Brandywine. It is also almost bisected by a modern State highway, so that it is only an hour's motor ride from Washington.

The elevation is from 80 to 230 feet, and the country is attractively undulating. A little of the narrow stream bottoms would require drainage, but the fall available is simple. The tract is all in the coastal plain, and a soil survey has been made of a considerable portion by the United States Bureau of Soils.[1] Thus the crop adaptations are quite well known in spite of the fact that tobacco is the only great staple crop heretofore grown on this particular area.

The climate of Prince Georges County is healthful and pleasant, with mild winters and a long growing season of about 180 days on an average. The range of temperature is quite great—from 16° below zero to 105° above. The mean temperature for the summer months is 73.6° and for the winter months is 35.6°. Killing frosts rarely occur between October 15 and April 20. The coastal plain of Maryland has had fewer damaging storms than any locality east of

[1] "Soil Survey of Prince Georges County, Md.," in Field Operations of the Bureau of Soils, 1901, United States Department of Agriculture, pp. 173–210.

the Mississippi River. The annual precipitation is about 41 inches and is quite well distributed. While the rainfall is ample for many crops and most types of soil, yet irrigation, though by no means necessary, would add materially to crop returns.

Splendid water is found at easy depths, and wells are plentiful.

This particular project opportunity was gathered together just before the last war by a corporation formed for the chief purpose of demonstrating the colonization adaptability of such "abandoned" land. Due to the World War and some other developments, nothing has been done with it as yet. The total cost to the company of some 13,000 acres in a solid body was $14.35 per acre. It is understood that the owning company would turn the property over to the Government for soldier settlement purposes only at original cost plus subsequent carrying charges, say, $18 to $20 per acre. From $17 to $25 per acre will be the cost of project lands in Maryland generally.

The reclamation work would consist of some drainage, a little terracing, clearing, road building, liming, and soil treatment, chiefly with leguminous crops.

Going-concern farms could be developed for about $75 an acre exclusive of the original cost.

MARYLAND AGRICULTURAL EXPERIMENT STATION,
College Park, May 13, 1919.

Maj. H. T. CORY,
Reclamation Service, Department of the Interior,
Washington, D. C.

DEAR MAJ. CORY: Inclosed herewith please find a supplementary statement with reference to the agriculture of Maryland, to be used, if you see fit, in connection with the statement which you made concerning the agriculture of our State. We feel that there should be a little more detailed and comprehensive statement made in order to give people an adequate idea of the possibilities of Maryland.

I am sorry that I could not have gotten this matter to you at an earlier date.

Very truly, yours,

H. J. PATTERSON, *Director.*

THE AGRICULTURE OF MARYLAND.

[Supplementary statement by J. H. Patterson, Director Maryland Agricultural Experiment Station.]

The agriculture of Maryland is conducted upon many different kinds of soils and under a wide range of climatic conditions owing to the considerable variations which are found to exist between the tide water lands at sea level in the east and the mountain lands over 200 miles to the west with an elevation of as much as 3,000 feet above sea level. Not only has the climate and the soils made a wide range of agriculture possible, but the different sections of the State have been settled by people with different inclinations and tendencies, which has resulted in the kind and degree of agricultural development being quite varied.

The total area of Maryland is 12,210 square miles, 9,860 of which is land surface, which, up to this time, is divided into about 50,000 farms averaging about 125 acres each. The principal farm crops have the following areas devoted to them annually:

Staple agricultural crops: Corn, 700,000 acres; wheat, 700,000 acres; hays and forage crops, 400,000 acres; barley, buckwheat, oats, and rye, 80,000 acres; tobacco, 30,000 acres.

Horticultural crops: Orchard fruits, 300,000 acres; vegetables, 100,000 acres; potatoes, 47,000 acres; small fruits, 18,000 acres.

For the purpose of agricultural classification, Maryland is naturally divided into four parts, viz: Eastern, southern, north-central, and western Maryland.

Eastern Maryland, popularly known as the "Eastern Shore," is composed of nine counties lying in the peninsula between the Atlantic Ocean and Chesapeake Bay and are as follows: Cecil, Kent, Queen Annes, Talbot, Caroline, Dorchester, Wicomico, Somerset, and Worcester.

The Easter Shore is uniformly level, with fairly good roads, which are easily and economically kept in repair. The land is considerably indented with tidal estuaries commonly called "creeks." Along many of these creeks are marsh lands which have luxuriant growths of natural grasses which are well adapted to grazing.

The proximity of the ocean and bay greatly modifies the temperature, so that this section enjoys a long growing season and very short, mild winters. In general, the soil and climate are exceptionally well adapted to the early production of vegetables and small fruits.

Southern Maryland is made up of five counties, lying between Chesapeake Bay and the Potomac River, viz: Prince Georges, Anne Arundel, Charles, Calvert, and St. Marys.

The surface of the land in southern Maryland is somewhat higher and more broken or rolling than the Eastern Shore. This is the principal tobacco-growing section of the State, and the soils and climate are well adapted to this crop. There is also much land well adapted to the staple agricultural crops and to vegetables and small fruits. Most of southern Maryland has good transportation facilities by both water and rail, and, being very near to both Baltimore and Washington, has good markets. Dairy farming has been found very profitable in the section near Washington, and what is known as the "Eastern Branch" trucking section produces the earliest local vegetables and small fruits which are found in the Washington market.

Less than one-half of the land in this section is under cultivation. Most of the uncultivated area is in woodland, yet considerable cleaned land is untilled. There is much land in large estates which is uncultivated because the owners are unable to work it to advantage.

North-central Maryland is composed of five counties, viz: Baltimore, Harford, Howard, Carroll, and Montgomery. The land in this section of the State is very rolling. It is generally rather a stiff clay and clay loam underlaid with rock and is well drained. The land is mostly cleaned and under cultivation. The valleys are usually very fertile. The farms in this section are generally small, varying from 50 to 150 acres, and in the most part tilled by their owners.

In this section mixed husbandry largely predominates with dairying, trucking, and canning being made very prominent. Baltimore is about the center of this area and Washington at one side, and with two such great cities there is a never-ceasing demand for all classes of farm products.

Western Maryland is composed of Garrett, Allegany, Washington, and Frederick Counties. This section of the State is wedged in between Pennsylvania and the Virginias, and is the mountainous portion of the State. Bituminous coal mines abound in Garrett and Allegany Counties and give a stimulus to industry and manufacturing operations. Prosperous farming is also carried on extensively.

Western Maryland is a succession of parallel ranges of mountains with deep and generally fertile valleys which drain chiefly into the Potomac River. The mountains reach 3,000 feet in altitude, and in the west form a high plateau on which are situated many productive farms. Garrett and Allegany Counties are naturally well adapted to grazing, and stock raising should be more largely pursued than at present. Apples do well in these counties. Oats, buckwheat, and potatoes are the principal crops. Garrett County produces about 250,000 pounds of maple sugar annually and about every farm has a chestnut grove which adds considerable to the county's income.

Washington and Frederick Counties abound in productive farms. Very little land in these counties is uncultivated, and they are the best farms of any in the State. The farms are generally tilled by the owners. The land is mostly of limestone origin. Wheat, corn, and hay crops are large. Considerable attention is paid to the raising of stock of all kinds. Horses from these counties are always in demand in Baltimore and Washington markets, and command the highest prices because of their endurance and general good qualities. Fruit growing has developed to large proportions in Washington

County within the last few years, and many mountain lands which a few years ago were considered almost worthless are now growing peaches, apples, plums, and cherries to perfection, and proving profitable investments.

SPECIAL AGRICULTURAL FEATURES OF MARYLAND.

The geographical position of Maryland with reference to the center of population, together with the climatic and soil conditions, make the following special kinds of farming pecularly adapted to the State: Canning, dairying, orchard fruits, small fruits, truck crops, poultry, sheep, and hogs.

Canning.—Maryland was one of the pioneer States in the canning industry, and still occupies a very important place in that business. At the present time Maryland stands first in the amount of tomatoes canned; first in peas; and fourth in corn. Maryland packs nearly half of all the tomatoes canned in the United States and about one-fourth of the total amount of peas.

Dairying.—Baltimore, Washington, Philadelphia, and Pittsburgh, together with numerous small towns, gives a good market for all kinds of dairy products, but especially so for milk and cream. These markets have caused a large dairy interest to grow up in the State and developed some exceptionally fine dairy farms and herds.

Orchard fruits.—Maryland was probably the pioneer State in the growing of orchard fruits on a commercial basis. The first large orchards were of peaches, and were planted in the year of 1800. The industry started in Anne Arundel County, south of Baltimore city, but soon reached the Eastern Shore, where it spread very rapidly until almost the whole shore was one large peach orchard. The extent of peach growing, with the beauty and quality of the fruit, made the State famous for this product. The "peach yellows" after some years worked destruction to many orchards and made the growing on the Eastern Shore unprofitable for a few years, but the industry in that section is again increasing rapidly. In 1875 the discovery was made that a belt of land along the South Mountain in western Maryland was peculiarly adapted to peaches, and the first commercial orchard was planted in that section. From the very small plantings made about 30 years ago at Edgemont, peach growing has developed in all directions, until the Maryland mountain peaches have taken a very prominent place in the markets. Pears, plums, and cherries are grown quite extensively in many parts of the State. Apples grow well in all parts of the State, and in every section will be found some commercial orchards. Chestnuts, shellbarks, English walnuts, filberts, and pecans grow in many parts of the State and are beginning to receive some attention commercially.

Small fruits.—The growing of small fruits receives special attention in all parts of the State, but is conducted on an extensive scale only in the vicinity of large cities and on the "Eastern Shore." While this industry had its inception in supplying the local markets it has now grown so that the shipments to the distant markets are more remunerative than the home trade. During the season Maryland berries are found in almost every city and town as far north as Montreal, Canada, and in plentiful seasons so far west as Cleveland and Chicago. Of the small fruits the strawberry is the most important, but raspberries and blackberries occupy a prominent place. Maryland produces more strawberries than any other State in the Union. Maryland has large areas of land well adapted to small fruits, which, together with the favorable climate, is sure to keep this one of the specialties of the farm, and the prominence of this crop will increase as the growers fully realize the response which they give to good management and intensive culture.

Truck crops.—Maryland has large areas well adapted to vegetables of all kinds, and fortunately these lands are situated near the large cities, and also near the water courses, which seem to give a climatic condition favorable to their growth. Vegetables are grown principally for their consumption in the fresh state, but also to a considerable extent for canning.

Truck farming will always be one of the great specialties, not only because of the good markets, but also because this class of farming gives quick returns for the labor and money invested. Again, truck farming will permit of growing two or three crops a season on the same land, which alone permits of relatively larger returns than most of the staple crops. Most all truck crops respond wonderfully to intensive manuring and culture.

Poultry, sheep, and hogs.—Poultry, sheep, and hogs are probably the most profitable live stock for Maryland farmers.

Poultry does well in the eastern, southern, and western parts of the State, and if properly managed there is no difficulty in having good yields of eggs in winter. In eastern and southern Maryland it is easy to have green pastures for poultry all the year. Good poultry always commands a good price as meat, and the market never seems to get enough eggs and the price is relatively high.

The growing of sheep wherever pursued is found quite profitable. The raising of early lambs is probably the most profitable branch of sheep raising and should be more largely pursued.

Hogs are extensively grown in the dairy and mixed husbandry sections of the State. They are reasonably free from disease and always meet with remunerative prices and ready sale. The raising of hogs is sure to increase when farmers in the cowpeas and soy-bean sections of the State come to realize the value of these crops in producing pork of exceptional quality very cheaply.

Transportation and Markets.—Maryland is well served by railroads in all parts—main lines are the Baltimore & Ohio; Northern Central; Philadelphia, Baltimore & Washington; Western Maryland; West Virginia, Central & Pittsburgh. There are numerous electric lines. Chesapeake Bay and its numerous branches furnish ample communication both internally and for export trade. There are also numerous connecting canals that help the inland communication. The Potomac River is likewise an important means of water communication in the South and West. Baltimore is a port of entry with extensive exports and imports.

Roads.—Maryland is famous for her well-built State-controlled road system. Excellent roads connect all important points—every county seat is connected with the State capital by improved highways. The State road system is being rapidly extended. There are now approximately 1,000 miles of State roads and 300 miles of State-aided roads. These roads are constructed of macadam, concrete, gravel, and shell.

SCHOOLS AND CHURCHES.

Maryland has a well-developed system of public schools which is improving yearly. Every farm is within reach of a good primary school, and all but three counties are well provided with high schools. The colleges of the State provide for higher education on liberal and economical terms.

Every section of the State is well provided with church facilities.

RESTING OR UNUSED LAND IN MARYLAND.

According to the Thirteenth Census, there was in Maryland in 1910, approximately 1,350,000 acres of improved land that was unproductive. The resting was distributed as follows:

County.	Resting land.		County.	Resting land.	
	Area.	Per cent of land improved.		Area.	Per cent of land improved.
	Acres.			*Acres.*	
Allegany	39,300	55.8	Howard	45,200	39.6
Anne Arundel	68,600	49.3	Kent	38,800	27.7
Baltimore	78,900	34.2	Montgomery	87,400	41.3
Calvert	51,500	69.5	Prince Georges	95,300	61.7
Caroline	43,600	34.1	Queen Annes	65,500	38.2
Carroll	59,200	26.2	St. Marys	53,900	54.8
Cecil	49,700	35.3	Somerset	34,200	44.7
Charles	80,600	66.3	Talbot	37,900	32.2
Dorchester	51,600	41.8	Washington	51,700	26.9
Frederick	85,100	28.0	Wicomico	43,800	40.1
Garrett	62,000	50.7	Worcester	54,000	43.5
Harford	73,200	42.7			

Some of the resting land is in such a low state of fertility that its cultivation is not profitable, but much of this improved land is not in crops because of lack of sufficient labor and capital. In addition to the improved land that is not being cropped there is within the State approximately 1,700,000 acres of

unimproved land, much of which might be developed for agricultural purposes. The potential value of this land is greatly enhanced by its proximity to great centers of population and the good transportation facilities offered by the railroads, the rivers and bays, and the splendid system of State highways.

MISSISSIPPI.

The governor of Mississippi has so far appointed no committee nor has the legislature taken any action concerning the soldier settlement program. The legislature has not been in session for over a year and will not convene until 1920. At a State-wide meeting of interested citizens, however, a committee was named which is performing the functions of the committee officially named in all the States of the southern district and will continue to do so until superseded by one officially designated. The members of such committee are: P. P. Garner, State commissioner of agriculture, chairman, Jackson; C. T. Stevens, Hattiesburg; J. B. Lusk, Jackson; R. M. Weaver, Corinth; J. C. Seller, Yazoo City; Lamar Henington, Hattiesburg; M. S. Connor, Seminary; and H. A. Camp, Hattiesburg.

The total area figures for Mississippi are:

	Acres.
Land	29,675,000
In crop	8,100,000
Unimproved in farms	9,500,000
Merchantable timber	5,500,000
Cut-over land	13,500,000
Swamp land	3,000,000
Overflow land	2,750,000

Total number of farms, 295,000.

In other words, about one-tenth is swamp land, another tenth overflow land, and nearly half is cut-over land; while somewhat more than one-fourth the land was in crop last year.

Practically the entire State is coastal plain and less than a twentieth is above the 500-foot contour. Only the southeastern tip about Mobile and a narrow strip along the Mississippi below Greensville is below the 100-foot contour. The highest point is 780 feet above sea level and the average for the State 300 feet. The wet lands, swamp and overflow, are very largely in a strip averaging about 50 miles wide along the Mississippi River.

Preliminary investigations in the field of project opportunities were confined to cut-over lands. The fact that there are about 13,500,000 acres of such land often held in large tracts as a by-product of recent lumbering indicates the relative extent of project opportunities. Many other attractive lands of other types will no doubt be brought forward when funds and authority permit dealing upon a concrete basis.

The Hattiesburg project.—Only the largest compact tract offered and examined will be described as fairly typical of those in cut-over areas. It is located in the southeastern part of the State and comprises land in Perry, Forrest, Jeff Davis, Lamar, and Covington Counties. Hattiesburg, a city of 25,000 people, and one of great railroad importance, is the chief city of the project. Sumrall, Lamar County, and New Augusta, Perry County, are next in importance. Many railroad lines run through this tract, among which are the Southern (New Orleans & Northeastern), the Gulf, Mobile & Northern, the Mississippi Central, and the Gulf & Ship Island.

The elevation of this land is from 200 to 350 feet above sea level, ranging from great, level areas to rolling and even hilly. The soil is a sandy loam, and in some places a silt loam, from 6 to 10 inches deep, with a subsoil of red sandy clay. In a few places the subsoil is of a yellowish color. Comprehensive discussion of these soils is given in the reports of the United States Bureau of Soils, which made a survey of Forrest County in 1911, Jones County in 1913, and Jeff Davis County in 1915.

The principal crops are corn, cotton, velvet beans, and potatoes, although all the staple southern crops thrive here. The native timber is the pine—both the long and short leaf—and, in relatively small quantities, scrub oak and gum.

The climate of the area is that of the warm Temperate Zone. For the summer months the mean temperature is 82° with a maximum of 103°, and for the winter months 51° with a minimum of about 10°, although the thermometer has been known to touch zero. A killing frost rarely occurs before November 1 in the fall or after March 1 in the spring, thus giving a growing season of an average length of 245 days. The mean annual precipitation is about 55 inches, is greatest in the winter, but is generally well distributed. Years of excessive rainfall or slight droughts are quite frequent, though in the past 10 years there have been only two damaging droughts.

Good water in abundant quantities is found at depth of from 25 to 500 feet, while in some places artesian water is found at a depth of from 70 to 300 feet and in others it is rare and found only at a depth of 1,000 feet.

This land is owned in enormous tracts, a great many of them over 50,000 acres in size. There have been offers of several hundred thousand acres by one company alone.

The price per acre of raw land here is $7.50.

The reclamation work would consist of some drainage and leveeing, clearing, addition to the soil of lime, phosphate, nitrate of soda, and humus, and road building. Going-concern farms would cost not to exceed $125 per acre, or not over $10,000,000 for an 80,000-acre colony.

In January of this year two soil experts from the Agricultural and Mechanical College made an examination of 120,000 acres of land in the Hattiesburg project and from their report I quote the following:

> On the whole the average of these lands appears to be as good as any lands in the Southern States—good drainage, soils easily cultivated, abundant rainfall, exceptional transportation facilities, good highways with lands in easy reach of several large commercial centers. Therefore we have no hesitancy in saying that we were very favorably impressed with them.

McNeill Branch Experiment Station,
Poplarville, Miss., May 21, 1919.

Mr. H. T. Cory,
Consulting Engineer, Reclamation Service,
Washington, D. C.

Dear Sir: I have read your report on the agricultural possibilities of Mississippi soils that have been offered the Government for soldier settlement projects and want to say that all your statements are substantially correct. For 17

years I have had charge of an experiment station located on typical cut-over pine lands and in this time have acquired a fair knowledge of the nature of such soils. Your report does not exaggerate the possibilities of these lands, but states in simple words the advantages and disadvantages that one must expect in developing them. In fact, I was one of the two soil experts who examined the lands offered at Hattiesburg and reference to this report will show that we substantially agree. The report referred to was made at the instance of the Mississippi Agricultural and Mechanical College.

For reasons mentioned in your report, ours is an extremely undeveloped section and if the plans of the department are carried to completion it will be the means of a great development in this section.

If I can be of any assistance to you at any time, it will afford me great pleasure to be called upon, and I know the director of the United States station at McNeill, Mr. S. W. Greene, will be equally glad to render assistance.

Yours, truly,

E. B. Ferris.

Meeting of Soldier Settlement Committee.

At a meeting of the members of the soldier settlement project, held at the Jackson Board of Trade at 10 o'clock a. m. on Tuesday, May 30, 1919, pursuant to the call of P. P. Garner, chairman, there were present and participating P. P. Garner, Jackson; J. B. Lusk, Jackson; M. S. Conner, Seminary; Lamar Hennington, Hattiesburg; C. Z. Stevens, by P. G. Jones, his proxy, Hattiesburg; H. A. Camp, by T. C. Hannah, his proxy, Hattiesburg; R. M. Weaver, by P. P. Garner, his proxy, Corinth. Absent, J. C. Zellner, Yazoo City.

It appearing that a quorum of the members of said committee were present, the meeting was called to order by the chairman, who stated that the meeting had been called for the purpose of considering the report of H. T. Cory, consulting engineer, covering his investigations of the State of Mississippi in connection with the soldier settlement project.

After a full discussion and careful consideration of said report, the following resolution was offered and unanimously adopted, to wit:

Be it resolved, That it is the sense of those here present that the report of H. T. Cory, consulting engineer, covering his investigation of the State of Mississippi in connection with the solder settlement land project, although general in its terms, is quite accurate and conservative.

The 13,500,000 acres of cut-over lands in south Mississippi is symbolic of the pioneer character of the section. It is largely the by-product of extensive lumbering industries, largely owned and controlled by nonresidents, who have acquired these lands for the sold purpose of manufacturing the merchantable timber into lumber and converting this into cash, with little consideration, until recent years, being given to land usage. The country, being sparsely settled by people with very limited means, equipped with meager, insufficient and inadequate farming implements, and without scientific agricultural training or expert advice, has not enjoyed the development of other sections of the United States not so rich in natural resources.

In more recent years, through the special aid given by the representatives of the Farm Extension Bureau of the Department of Agriculture, people at home and abroad have been made to realize the value of these lands for the production of cotton, corn, oats, hay, sweet and Irish potatoes, peanuts, sugar cane, velvet beans, fruits, and vegetables, all of which are now being successfully and profitably grown. In addition, the bountiful supply of pure water, supplied by a number of live streams, has given great impetus to hog, sheep, and cattle raising, and especially to dairying. Faith in the possibilities of these lands has recently been substantially evidenced on the part of resident and nonresident owners of large tracts, who have made heavy expenditures in establishing farms that have already demonstrated the agricultural and stock-raising possibilities of this section; but the task is of too great magnitude for the capital and labor they can command.

A factor which has in the past deterred the people from the North and East from considering this district was the general misunderstanding of climatic and

health conditions. We here set out the record of the average temperature for a period of 50 years:

Climatic conditions.

Mean temperature:	
January	57
February	49.2
March	56.7
April	62.3
May	73.1
June	78
July	79.8
August	80.3
September	73.6
October	63.3
November	54.4
December	49.8

Mean temperature for last 50 years:	
January	50
February	51
March	63
April	67.5
May	71
June	78
July	81
August	81
September	76
October	62
November	54
December	50
Annual mean temperature	67.8

Average rainfall for last 50 years:	Inches.
January	5.54
February	5
March	6.1
April	5.36
May	3.90
June	2.87
July	5.59
August	5.75
September	3.75
October	2.07
November	4.35
December	5.01

Rainfall for 1916:	
January	7.24
February	3.38
March	3.73
April	3.37
May	4.96
June	2.87
July	.15
August	4.43
September	.15
October	3.21
November	2.73
December	4.08
Mean annual rainfall	58.5

Humidity (relative humidity):	Per cent.
January	85
February	75
March	73
April	72
May	72
June	77
July	86
August	80
September	74.5
October	76
November	73
December	80
Mean annual humidity	77

While occasional maximum temperature here, as in other parts of the United States, may seem high, we submit that the mean temperatures are extraordinarily favorable. These higher mean temperatures of the day are further ameliorated by the gentle Gulf breeze, the nights being invariably cool and pleasant.

The question of health, in so far as this section is concerned, we believe has now been settled once for all. Camp Shelby is located in the midst of the soldier-settlement project covered by the report of Mr. Cory. We can point to no higher or better authority than the comparative health record covering all the Army camps and cantonments in the United States, which is as follows:

Camp:	Annual death rate.
Beauregard	55.0
Bowie	35.4
Cody	40.6
Greenleaf	32.3
Hancock	37.2
Kearny	18.0
Logan	21.5
MacArthur	19.8
McClellan	29.5
Sevier	38.5
Shelby	9.4
Sheridan	19.6
Wadsworth	22.2
Wheeler	23.0
Custer	42.2
Devons	46.2
Dix	41.8
Dodge	50.5
Custis	33.1
Forrest	39.3

Camp—Continued.	Annual death rate.
Fremont	20.4
Greene	48.8
Funston	43.5
Gordon	15.9
Grant	59.0
Humphreys	57.6
Jackson	23.5
Johnston	17.1
Las Casas	17.5
Lee	31.2
Lewis	12.8
Meade	42.3
Pike	25.7
Sherman	68.6
Taylor	39.9
Travis	18.6
Upton	28.4

These figures were submitted the first part of January, 1919.

P. P. GARNER, *Chairman.*
J. B. LUSK, *Secretary.*

NORTH CAROLINA.

The committee representing the Commonwealth of North Carolina was appointed by Gov. Thomas W. Bickett, in February, 1919, and consists of Mr. George Herbert Smith, chairman, Wilmington; Capt. George T. Leach, Washington; and Mr. J. R. Page, Aberdeen.

In addition to this committee many data and much valuable assistance were furnished by Mr. Hugh McRae, of Wilmington; Mr. Mark Potter and his associates about Bell Haven; Mr. F. H. Aberly; and numerous other public-spirited gentlemen of Newbern; Mr. Millard and associated officials of the John I. Roper Co; and the North Carolina Landowners' Association.

The total area figures of the State are approximately:

	Acres.
Land area	31,200,000
In crop	7,250,000
Unimproved in farms	13,500,000
Merchantable timber	7,500,000
Cut-over land	13,000,000
Swampland	1,000,000
Wet grazing land	500,000
Periodically overflow land	500,000
Periodically swampy land	750,000

Total number of farms, 275,000.

That is, less than one-fourth the State was in crop last year, an equal amount is in merchantable timber and nearly half is cut-over land. About one-tenth is wet land, but much of this is also cut-over land.

North Carolina is essentially an agricultural State, having a population of about 2,200,000 and no city with 40,000 inhabitants (1910 census) and but two with over 20,000. To-day (1919) there are perhaps two cities with over 40,000.

The State is 485 miles long east and west and reaches from the Atlantic to the heart of the Alleghany Mountains—including the highest elevation east of the Mississippi River, 6,711 feet above sea level. In a general way, the eastern quarter is under the 100-foot contour, the next quarter between the 100 and 500 foot contours, the next quarter between the 500 and the 1,000 foot contours, and the western fourth higher than 1,000 feet—all these contours running approximately parallel to the eastern and western boundaries.

Investigations of soldier-settlement colonies were confined to the eastern part—under the 100-foot contour—simply because in this

region are many holdings of land of excellent quality, requiring only drainage and clearing to fit them for farm uses. There are doubtless many opportunities in the western end for stock-breeding colonies, such as outlined for southern Kentucky and West Virginia; in the Piedmont Plateau section for "abandoned" land colonies, such as recommended for Maryland and Virginia; and in the Thermal Belt for relatively large fruit colonies. When authority and funds are available for dealing upon a definite basis, State-wide notice will doubtless result in attractive offers from all over the State.

Five meritorious projects along the coast were investigated in considerable detail—a total of nearly a million acres—the most northern one being in the Dismal Swamp, which lies partly in this State and partly in Virginia. This famous swamp is now well on the way of being reclaimed by private interests.

The Newbern project.—Only one of the areas examined will be described, that known as the Newbern project, which is fairly typical of conditions in the northeastern portion of the State; and as far as climate, length of growing season, and rainfall are concerned is typical also of the area north and west of the city of Wilmington. The Newbern project comprises a large part of Craven County, and small portions of Carteret and Jones Counties. Newbern, the county seat of Craven County, situated on the Neuse River, with a population of 10,000 (1910 census), is just north of the proposed tract, and is the closest city of any importance. The main part of the project lies between the Norfolk & Southern Railroad on the east and the Newbern branch of the Atlantic Coast Line Railroad on the west, and consists of 150,000 acres. The Trent and Neuse Rivers, which pass through these lands, are navigable for boats of 9-foot draft.

The whole section requires drainage. The central portion is a high, broad, flat summit of land called a pocoson, which has an elevation of between 42 and 80 feet above sea level. The outer edges are much better drained than the central portion. In the better-drained portions the soil is dark-gray, fine sandy loam from 4 to 12 inches in depth, with a sticky, yellow clay subsoil, and its natural growth is pine. Back in the central part of the tract, where the drainage is poorer, the soil consists of a black muck from 1 to 3 feet in depth, underlain by a clay subsoil. On this there is a strong growth of gum, cypress, maple, poplar, and pocoson pine. When properly drained, cleared, and cultivated this land will produce excellent crops of corn and cotton. The United States Bureau of Soils in 1900 made a survey of the Raleigh to Newbern area and in 1903 the Craven area.

The winters in this locality are unusually mild, having a mean temperature of 45.2° and a minimum seldom below 18°. The summers are pleasant, with a maximum temperature of 96° and a mean temperature of 77.3°. There are nearly seven months in the year when no killing frosts occur. The average date of the first killing frost in the fall is November 4 and the last in the spring April 1, leaving a growing season of 218 days. The annual precipitation averages about 56 inches, is well distributed, but greatest in the summer months, when growing plants most need the rain, and least in the fall during the season of harvest. Well water of good quality is found at a depth of 10 to 30 feet. The land is owned in large

tracts, averaging over 10,000 acres, and the largest single holding contains 39,000 acres. The price asked per acre is $9.

The reclamation work would consist of road building and extensive drainage, clearing, the addition to the soil of lime and of fertilizing ingredients. The average per acre going concern farm with a project of 80,000 acres or more would probably not exceed $125 per acre.

The great areas north and west of the city of Wilmington which have not been described are principally served by the Atlantic Coast Line Railroad and the Seaboard Air Line Railway and differ from the Newbern area in having larger percentage of soils of the sandy loam types and a somewhat longer growing season. Lands of the sandy loam type are adapted to a wide range of farm products, including practically every crop grown in the United States except the citrus fruits.

SOUTH CAROLINA.

The official committee for South Carolina, as appointed by Gov. R. A. Cooper, consists of R. N. Lathan, chairman, Charleston; William Gifford, Gifford; W. H. Andrews, Andrews; E. W. Durant, Charleston; and Joseph Shank, Georgetown.

In addition, Senator Nathan Dial, ex-Gov. D. C. Hayward, the South Carolina Landowners' Association, with its secretary manager, Mr. George R. Wheeler, and Mr. C. S. Ucker, vice president and general manager of the Southern Settlement and Development Organization, rendered most helpful assistance.

The total area figures for South Carolina are:

	Acres.
Land	19,516,000
In crop	6,900,000
Unimproved in farms	7,400,000
Merchantable timber	3,000,000
Cut-over land	9,500,000
Swamp land	1,500,000
Periodically swamp land	1,000,000
Overflow land	625,000

Total number of farms, 190,000.

Thus, nearly one-eighth is wet land, one-half is cut-over land, and about two-fifths in crop last year. The swamp land consists almost entirely of a strip 50 miles wide along the Atlantic Ocean, and much of it is cut-over land as well.

Almost one-third the State is below the 100-foot contour, a third between the 100-foot and the 500-foot contours, and the remainder from 500 feet to a maximum of 3,548 feet above sea level. The lines dividing these thirds run quite parallel to the coast line and the mean elevation of all is 250 feet.

Like North Carolina on the north and Georgia to the south, the State has three physiographic divisions, coastal plain, Piedmont Plateau, and the mountain region. About one-half of the State is coastal plain or "low country," and to this portion all the investigations were confined—indeed, to the lower pine-belt part of it.

There are no doubt attractive project opportunities both in the "up country" and in the upper pine belt of the "low country," which will be brought out by widespread notice when definite dealing may be in order. The lower pine-belt part of the low country

is, however, the least developed, and the first investigations were therefore naturally centered there.

The Georgetown project.—Of the four large projects outlined and examined, with a total of almost 600,000 acres, a quite typical one is selected for description, the Georgetown project. This is a belt about 10 miles wide and 30 miles long extending from northeast to southwest through the center of Georgetown County. Only about 5,000 acres of the project lie outside of this belt. There is only one town of any size in the whole county and that is the county seat, Georgetown, with a population of about 6,000, which is 5 miles from the center of the area. Its only railroad connection is a branch of the Seaboard Air Line, which connects with the main line at Lanes. While the railroad facilities are poor, the water transportation facilities are excellent. The Peedee, Black, and Santee Rivers are navigable beyond the limits of the county and the Sampit for about 10 miles from its mouth.

The topography is level to gently undulating except where cut by the Black River, where it becomes more like the sand-hill country. The elevation for the most part is around 30 feet above sea level.

The soils of this area are unusually uniform and consist of three types—Coxville fine sandy loam, Portsmouth loam, and Norfolk fine sand. There is probably no finer soil for general farming in the coastal plain than the Coxville fine sandy loam, when well drained. Rice is the principal crop, though after drainage has been completed cotton, corn, oats, and cowpeas can be easily raised. The native timber is typically that of the pine plains and gum swamp growth. In 1912 the United States Bureau of Soils made a survey of Georgetown County, which includes the region under discussion.

The climate is mild with winters short and open, having a mean temperature of 51° and a minimum of 7°. The summers have a mean temperature of 81° and a maximum of 104°. The average date of the first killing frost in the fall is November 30 and the last in the spring March 3, thus giving a growing season of nine months. The mean annual precipitation is 50 inches and is well distributed.

An abundance of good water is to be found.

The project as drawn contains 97,000 acres held by some 44 different owners. The tracts are comparatively small for this part of the State, the prices for which range from $5 to $15 per acre.

The reclamation work would consist of extensive drainage, clearing, mosquito prevention, road building, and the addition to the soil of lime, phosphate, nitrogen, and humus. The total cost of going concern farms would not exceed $100 per acre or $10,000,000 for a 100,000-acre project.

OKLAHOMA.

The committee appointed by Gov. J. B. A. Robertson to represent the Commonwealth of Oklahoma consists of State Senator E. M. Kerr, Muskogee; State Senator T. P. Hill, McAlester; State Senator R. L. Davidson, Tulsa; State Senator T. C. Simpson, Thomas; Representative Bert Jackson, Chickasha; and Representative James Hollarn, Cement.

In addition, committees were appointed by the chambers of commerce at Oklahoma City, Tulsa, and others, and especial thanks are due all of them for enthusiastic and very helpful assistance.

The total area figures are:

	Acres.
Land	44,421,000
In crop	13,750,000
Unimproved in farms	8,500,000
Merchantable timber	4,500,000
Cut-over land	3,000,000
Swamp land	75,000
Overflow land	200,000

Total number of farms, 220,000.

The wet and overflow lands are chiefly along a few streams in the eastern part of the State where is also located the cut-over and inferior timberlands. Considering the extent of Indian-owned lands, and the relatively light rainfall in the western portion, the area of land in crops last year—13,750,000 acres—is surprising. This is more than half that in Texas and over a million acres more than any other State in the southern district—Georgia following with 12,624,000 and Alabama next with 10,570,000 acres. Further, although only 12 years old in its present form, its population is almost if not quite 2,500,000 and its largest city well above 100,000.

The United States Reclamation Service had already quite thoroughly examined the irrigation possibilities without discovering any attractive possibilities of any size. Therefore the investigations were confined to drainage and cutover land, although it was recognized that stock breeding colonies along the same general lines as those outlined in southeastern Kentucky and West Virginia might be desired by many soldier settlers and that the release of certain Indian lands would enable several additional attractive diversified farming projects to be planned. The official Oklahoma committee was appointed too late to take any action as to the type of colony or colonies preferred by Oklahoma or to consider the matter of releasing Indian lands, and so justify additional investigations before preparing this report.

Considering only the data now at hand, it will not be desirable to consolidate all soldier settlement in one colony—there should be several of 25,000 acres and under, several opportunities for which have been examined.

Practically all of the State is above the 500-foot contour and the western half is from 1,000 feet to a maximum of 4,750 feet above sea level; the lowest extreme is 300 feet and the mean elevation 1,300 feet. None of the rivers are large; no overflow bottom lands over 3 miles wide. Some of the streams are, however, sluggish and tortuous.

The Verdigris project.—Three project opportunities will be described as sample ones of different types. The first, the Verdigris project, is located north of Muskogee in Wagoner County along the Verdigris River. The region is already well developed and readily accessible to the markets. The upper end is about 6 miles from Inola, located on the Missouri Pacific Railroad, and the lower end is from 3 to 6 miles from Porter, on the Missouri, Kansas & Texas Railroad. Close to its eastern edge the St. Louis, Iron Mountain & Southern, and the Missouri, Oklahoma & Gulf Railroads run.

The largest part of this region consists of prairie plain and bottom lands, with a topography nearly level to rolling, and an

elevation from 500 to 700 feet above sea level. The types of soil divide themselves into three groups—first, Great Plains (residual prairie) soils; second, Ozark border soils; and, third, alluvial soils. These soils produce cotton, corn, potatoes, alfalfa, and other crops already, and when properly drained would be unusually fertile. Most of this land is quite heavily timbered and the rest of it has a scattering of timber. A considerable portion of this wooded area is saw timber ranging from 10 inches to 3 feet in diameter. The timber consists of white oak, burr oak, red oak, pin oak, water oak, ash, black walnut, pecan, hickory, elm, soft maple, locust, and cottonwood. The nearest soil survey that has been made is the one of Muskogee County, made in 1913 by the United States Bureau of Soils.

The climate of this region is exceptionally favorable for agricultural pursuits. The winters are short and extreme cold is a rarity. The mean winter temperature is 39.3° with a minimum of 14° below zero, and the mean summer temperature is 78.3° with a maximum of 109°. The average date of the first killing frost in the fall is November 2 and the last in the spring is March 30, giving a growing season of 217 days. The mean annual precipitation is reported at 38.98 inches and is quite well distributed. There are periods of drought nearly every summer but only in isolated instances are they of serious damage to the crops.

At a depth of from 40 to 70 feet a bountiful supply of good water can be secured.

The land in this locality is owned in relatively small tracts. The price per acre is reported at $50.

The reclamation work would consist largely of drainage, some leveling and clearing, and road building. It is estimated that the cost of entirely reclaiming this land would be about $40 per acre, which expense would be justified because it would bring into cultivation some of the richest land in the Southwest with a selling value of $150 per acre. The total cost of soldier-settlement going-corncern farms would not exceed $125 per acre.

The Atoka project.—One of the most desirable available bodies of land for soldier settlements in Oklahoma lies in Atoka, Coal, and Pontotoc Counties, and comprises approximately 60,000 acres. This tract lies in what is known as the Clear Boggy River Valley. The largest towns in this region are Atoka, Coalgate, and Ada, the county seats of Atoka, Coal, and Pontotoc Counties, respectively. Several branches of the Missouri, Kansas & Texas Railroad traverse this area, as well as the St. Louis & Santa Fe and the Missouri, Oklahoma & Gulf Railroads. Drainage is furnished through the Clear Boggy River.

The topography of this area is from level to rolling. No soil surveys have been made by the United States Bureau of Soils anywhere very near this tract, the closest being the survey made of the Muskogee area in 1913. The soil is of that rich black sandy loam, in general, and is a deposit of the rich topsoils of the upcountry which has been washed down and quite evenly distributed by reason of stiff currents and many eddies and certain areas of backwater. This topsoil is wonderfully fertile and runs as high as 14 feet in depth. Cotton and corn are the principal crops. Vegetables and all kinds

of garden truck are also raised. Most abundant growths of grasses are also found here. The native timber consists of pine and oak.

The climate of this region is unusually adapted to agriculture. The summers are warm and the winters mild, no long spells of very cold weather occurring. The growing season is a long one, consisting of about seven and a half months—from March 1 to the middle of October. The annual rainfall is particularly well distributed and averages from 45 to 50 inches.

The district committee for this section reports the price for which these lands could be purchased as follows, approximately: Bottom land, unimproved, 58,000 acres, at $20 per acre; partially improved, 2,000 acres, at $75 per acre.

Certain reclamation work would be necessary in order to make a portion of this land available for cultivation, consisting of drainage, clearing, road building, and the addition to the soil of certain elements. The estimated average cost per acre for reclamation work is as follows:

Atoka County	$9.40
Coal County	13.19
Pontotoc County	13.42

The committee hereinabove referred to has furnished blue prints and other reclamation data.

The Osage project.—There are several areas in Osage County which would be available for soldier-settlement live-stock projects. This region is immediately north of the Arkansas River, which furnishes drainage for it. Pawhuska, the county seat of Osage County, is a progressive little town of about 3,000 inhabitants. The Missouri, Kansas & Texas Railroad passes near and the Midland Valley Railroad passes through Pawhuska. The Atchison, Topeka & Santa Fe Railroad traverses the southwestern part of the county.

These lands are from level to gently rolling. No soil survey has been made by the United States Bureau of Soils except the one of Muskogee County before mentioned. The soil is a sandy loam and produces cotton, corn, wheat, and abundant grasses. The raising of live stock is the most successful occupation. Native timber consists principally of the hardwoods, though the whole area is but sparsely timbered.

The climate of this region is temperate and healthful. The absolute extremes in temperature are 107° above and 16° below zero. The average mean summer temperature is 78.5° and for the winter 37.5°. The average date of the first killing frost in the fall is October 26 and the last in the spring is April 3, giving a growing season of about six and a half months. The annual precipitation is well distributed and averages about 42 inches.

As much as 10,000 acres could be rounded up in one boundary, and this could be bought for an approximate price on the average of $12.50 per acre. It would be necessary, however, to have certain small Indian allotments released by the removal of the Indian sales restrictions, but the establishment of a model cattle-producing industry in Osage County would be most attractive and profitable to the investor.

The reclamation work would consist of drainage, land clearing, road building, and the addition to the soil of phosphate, humus, nitrate of soda, and lime.

A large area of Osage County is now used as a cattle range, the native grasses furnishing the forage.

TENNESSEE.

The investigations in Tennessee were carried on in cooperation with the committee appointed by the Nashville Commercial Club, the Knoxville and Memphis Chambers of Commerce and the official committee appointed by Gov. A. H. Roberts, consisting of: W. R. Manier, chairman, secretary Commercial Club, Nashville; Wilbur A. Nelson, secretary, State geologist, Nashville; Dr. H. A. Morgan, dean of agricultural department, University of Tennessee, Knoxville; Dr. F. M. McRee, commissioner of agriculture, Union City (after June 1, Nashville); and George N. Welch, railroad commissioner, Nashville.

The total area figures for the State are:

	Acres.
Land	26,680,000
In crop	7,250,000
Unimproved in farm	9,250,000
Merchantable timber	7,000,000
Cut-over land	7,800,000
Wet land	1,000,000

Total number of farms, 260,000.

Most of the wet lands are in a strip about 25 miles wide along the Mississippi River where the effectiveness of reclamation depends upon levee systems. The amount of cut-over lands about equals last year's cropped area—each somewhat less than one-third the total land.

Tennessee is a little over 100 miles north and south and 400 miles long, extending from the Mississippi River on the west to the ridge of the Appalachians on the east. The highest point in the eastern end is 6,636 feet above sea level, the mean elevation for the State 900 feet and the lowest point 182 feet.

There are six principal physiographical features—the Unakas or Great Smokys, valley of east Tennessee, Cumberland plateau, Highland Rim, Central or Nashville Basin, and west Tennessee plateau and bottom lands.

The Unakas is a belt about 13 miles wide along the entire eastern edge of the State about 1,275,000 acres foothills to the Unaka or Great Smoky Mountains. This belt lies above 1,500 feet and is a region of often rounded crests suited for grazing, steep timber, coned slopes, and deep gorge-like ravines. Practically all of the land is too steep for cultivation but there are small farms along the streams and broader coves. It is the "land of the sky" timbered with yellow poplar, hemlock, spruce, chestnut, and a great variety of valuable hardwoods, contains great water-power opportunities and abundant grazing grounds, and the land held in large blocks. Here exist several opportunities for stock-breeding colonies like those suggested for eastern Kentucky and West Virginia.

West of the Unakas lies the valley of east Tennessee, which averages 50 miles wide, contains about 5,900,000 acres, and is about 1,000 feet above sea level. It is a region of long northeast-southwest limestone and shale valleys separated by narrow saw-footed ridges

of sandstone and chert. Agriculture is the chief industry and land holdings are of moderate size as the limestone valleys contain heavy soils or loams which are fertile, strong, durable, and suited to diversified farming. This is the most advanced region agriculturally. There are great water-power possibilities in this region.

Next to the west is the Cumberland Plateau—a high tableland 1,000 feet above the valley of east Tennessee on the east and 800 feet above the Highland Rim on the west. It faces the former with a fairly even escarpment 1,000 feet high and generally precipitous, while on the western side it forms a series of projecting headlands. Consequently from either edge of this plateau wonderful views of the broad rich valley to the east and to the west are to be had. The area is from 30 to 50 miles east and west, extends clear across the State and comprises about 2,816,000 acres. Its elevation varies from 1,500 to 2,000 feet above sea level. Summer climate and many springs give use to a large number of health resorts. Its soil has generally been considered of small agricultural value and lumbering and coal mining are the chief industries. Perhaps half the land is held in large holdings for the coal and timber, or both. Surface rights to cut-over lands are held at only a few dollars an acre.

The Highland Rim is a broad shelf completely surrounding the Central or Nashville Basin, with an average elevation of 975 feet above sea level, and an area of 6,000,000 acres. It is a rolling country underlain chiefly with limestone, though on the edge facing the Central Basin the rock is mainly chert. The limestone soils are fertile, while the cherty lands are more difficult of improvement. The chief industry is agriculture, although on the western rim lumbering and iron and phosphate mining are of local importance.

The Central or Nashville Basin lies about 400 feet below the Highland Rim or 500 feet above sea level. It is a limestone basin containing about 3,500,000 acres. On the southwestern side the rock is rich in phosphate and large quantities are now being mined. The topography is beautifully rolling, with hills from 50 to 150 feet above the adjoining valleys. The region is agriculturally rich, well watered, and natural legume and blue-grass land. The development is high and, except for a few large estates, the land is held in small farms.

The Tennessee River, after traversing northern Alabama, rather curiously flows across the State almost exactly from south to north, emptying into the Ohio River and cutting off to the west about one-fourth of Tennessee. This region is known as the West Tennessee Plateau and bottom lands. It contains two distinct topographic features—the rolling, broken-up lands between the Tennessee and Mississippi Rivers and the stream bottoms. The uplands reach elevations of 613 feet, and average from 200 to 400 feet above the streams. The bottom lands are usually often subject to overflow, since the smaller streams are only slightly higher than the main river channels and have shallow, tortuous channels. The bottom lands are relatively small in area but large in agricultural importance. The Tennessee River Valley in west Tennessee contains about 750,000 acres, practically all under cultivation, and the Mississippi Valley about 650,000 acres, considerable of which is yet to be reclaimed, still being covered with dense vegetation and spotted with lakes and marshes. These lands are, of course, extremely fertile and project opportunities no doubt exist in this region, especially of moderate size.

In large measure following the advice of the several Tennessee committees, surveys were confined to the Cumberland Plateau and the Highland Rim. The essential characteristics of soldier settlements in each of these regions would be similar and so only one opportunity will be described.

The Mayland project.—The Mayland project is located in Cumberland County, which is geographically the center of the Cumberland Plateau. The largest town in the area is Mayland, with a population of 200, while Crossville, 14 miles distant, the county seat, has a population of 1,500. It is equally distant, being about 100 miles from Knoxville, Chattanooga, and Nashville, three of the large industrial centers of the State. The Tennessee Central Railroad, with one or two branch mining and logging roads, runs through the tract, and the Memphis to Bristol Highway is at present being graded through the project.

The lay of the land is from level to gently undulating, very little being rough or rugged, with an average elevation of 1,800 feet above sea level. The soil is quite uniform, consisting of fine sandy loams with good retentive clay subsoils; corn, potatoes, clover, soy beans, vegetables, and when cared for, small berries can be grown. The backward condition of these lands is due to the fact that the people in this section have been trained in lumbering, and have been without agricultural experience and training. The native vegetation consists mostly of hardwoods, although in the soft woods black gum and poplar are found.

The climate is unusually pleasant, the winters being neither long not serve and the summers not too hot. The mean summer temperature is about 71° with a maximum of 97°, and the mean winter temperature is 36°. The ordinary coldest winter day is but little below zero. Killing frosts are not expected before October or after April, thus giving a growing season of between six and seven months. The mean annual precipitation, which is well distributed, is reported to be 55 inches. The United States Bureau of Soils has made no survey of Cumberland County itself, but in 1912 a survey was made of the Putnam County area to the northwest and in 1903 of the Pikeville area immediately south of the Mayville project.

Water supply is obtained from the many creeks of pure water. For domestic purposes an abundant supply of excellent freestone water is obtained at a depth of from 30 to 60 feet. Artesian flow is found at 350 feet and deeper.

In January, J. L. Napton, land examiner, investigated these lands and reports:

> I believe the possibilities are unlimited for a project, and an unlimited amount of land can be gotten all the way from 30,000 to 150,000 acres. The soil and contour conditions are uniform throughout the area.

The land can be bought for an average price of from $10 to $15 per acre.

The reclamation work would consist of a little drainage, clearing, road building, and the addition to the soil of lime and phosphate, the latter is especially accentuated. The poverty of the land in this mineral constituent is the only reason for the present prevalent idea that the soil of the Cumberland Plateau has little agricultural worth, and the consequent low land values.

REPORT OF SOLDIER SETTLEMENT BOARD OF TENNESSEE.

The report on Tennessee, which was prepared by the Department of the Interior, United States Reclamation Service, through their consulting engineer, H. T. Cory, has been critically read and analyzed and, in the opinion of the committee, found to be very conservative. This report is approved in so far as it goes, but it is considered that many important facts and conditions that exist in Tennessee (making this State, and especially the Cumberland Plateau, admirably suitable for soldier settlement projects), have not been stressed or fully explained. The committee has therefore prepared the following brief report, to be added as an appendix to Mr. H. T. Cory's report:

CUMBERLAND PLATEAU.

Climatic conditions.—The temperature is about 10° lower than the Middle Tennessee Basin, making living conditions from a climatic standpoint ideal. The rainfall is high and a long, dry season is the exception. A cooperative weather station of the United States Weather Bureau has been in operation for the last 22 years at Erasmus, Cumberland County, a post office about 3 miles east of Clifty. The observer is Mrs. E. D. Ashley. The climatic conditions at this place are similar to the conditions that prevail on other parts of the Cumberland Plateau.

The following is a condensed table taken from the annual report of the Weather Bureau:

Year.	Killing frost.		Growing season (days).	Lowest temperature.	Date.	Highest temperature.	Date.	Average temperature.	Rainfall.	Snow.	Wind.	Rainy days.
	Last.	First.										
1897	.....	.....	.....	−19	Jan. 28	91	July 1	.....	64.42	.....	SW	124
1898	.....	.....	.....	− 5	Feb. 3	95	June 9	54.6	52.14	12.1	SE–SW	140
1899	Apr. 17	Sept. 30	165	−30	Feb. 13	95	Sept. 7	54.2	64.70	19.1	SW	140
1900	May 4	Nov. 4	183	−10	Jan. 2	96	Aug. 11	55.2	53.40	13.5	SW	128
1901	Apr. 4	Oct. 15	193	−15	Dec. 21	96	July 22	52.1	.....	.....	SW	.....
1902	Apr. 3	...do....	179	+ 5	Feb. 5	95	June 12	54.2	59.91	21.2	SE	116
1903	Apr. 24	Oct. 19	177	− 5	Feb. 18	91	July 28	53.4	60.00	8.4	SE	116
1904	Apr. 21	Oct. 21	132	+ 3	Jan. 27	92	July 18	53.2	49.07	8.4	SE	111
1905	Apr. 18	Oct. 12	176	.....	.....	90	June 18	.....	.....	.....	.....	.....
1906	May 10	Oct. 10	153	− 1	Dec. 24	91	Aug. 20	54.9	63.05	7.4	SE	148
1907	Apr. 18	Oct. 12	179	+ 5	Dec. 5	93	July 9	54.9	59.21	2.9	SE	127
1908	May 1	Sept. 29	151	0	Feb. 3	93	Aug. 3	55.2	53.07	8.5	SE	115
1909	May 2	Sept. 28	149	− 4	Dec. 30	93	Aug. 27	54.9	66.17	4.5	SE	130
1910	May 15	Oct. 23	161	+ 1	Feb. 14	90	Aug. 17	53 3	50.85	25.8	SE	137
1911	Apr. 17	...do....	188	0	Jan. 5	95	June 4	56.0	62.34	1.4	SE	135
1912	Apr. 9	Oct. 24	197	−10	Feb. 5	91	July 14	53.2	68.22	9.7	SE	130
1913	Apr. 6	Sept. 22	169	+ 6	Feb. 13	97	July 18	55.7	57.06	4.0	SE	103
1914	Apr. 10	Oct. 27	200	−18	Dec. 15	97	June 25	54.5	60.05	22.8	SE	121
1915	Apr. 18	Oct. 8	173	+ 6	Jan. 21	95	July 31	54.7	63.92	26.3	SE	122
1916	Apr. 10	Oct. 1	174	.....	.....	.....	.....	.....	.....	.....	.....	.....
1917	May 14	...do....	140	−14	Dec. 9	94	Aug. 1	52.8	65.07	26.5	W	139
Summary	May 15	Sept. 22	[1] 200	+ 6	Feb. 13	90	.....	52.1	49.07	26.5	.....	148
			[2] 132	−30	1899.	97	.....	56.0	68.22	1.4	.....	103
Average	.....	.....	171	− 8	.....	93½	.....	54.3	59.59	13.8	.....	126

[1] Longest season.

[2] Shortest season.

Rainfall is evenly distributed throughout the year.

Water supply—streams and wells.—The streams of the Cumberland Plateau drain into tributaries of the Cumberland and Tennessee Rivers. Many of these streams start at springs and their flow is supplemented throughout their course by the waters from additional springs. These springs are generally of freestone water, but occasionally a fine chalybeate water is found. The stream water is always a freestone water, without sediment, and would not need filtering. It is entirely suitable for all kinds of stock.

The following is an analysis of stream water from Doe Creek, DeRossett, just across the Cumberland County line, in White County:

Analyses.

	Gr. per gal.
Incrusting solids:	
Iron and al. oxides	0.133
Silica	0.377
Calcium carbonate	0
Calcium sulphate	0
Calcium chloride	0
Magnesium carbonate	0
Magnesium sulphate	1.544
Magnesium chloride	0.490
Total incrusting solids	[1] 2.544
Nonincrusting solids:	
Sodium and potassium chloride	0.106
Sodium and potassium sulphate	0
Sodium and potassium carbonate	0
Sodium and potassium nitrate	0
Total nonincrusting solids	0.106
Suspended matter	0
Organic matter	0
Total incrusting solids	2.544
Total solids	2.650

Analyzed by Baldwin Locomotive Co., 1906.

The wells on the plateau obtain an unfailing supply of water from any of the thick sandstones that underlie the clay surface. As a rule water can be obtained in 40 feet, but sometimes it is necessary to go 100 feet in order to get a large quantity. In places where the rock structure is suitable artesian flows can be obtained at depths of approximately 150 feet and deeper. There is such a well in Cumberland County, 7 miles southeast of Crossville; also in the northeast corner of Bledsoe County, and another to the south of Tracy City. The Tracy City well when drilled had a capacity of 200 gallons a minute. An analysis of the water from this well follows:

Analysis.

	Gr. per gal.
Incrusting solids:	
Iron and al. oxides	0.023
Silica	0.490
Calcium carbonate	3.959
Calcium sulphate	Trace.
Calcium chloride	0
Magnesium carbonate	1.539
Magnesium sulphate	0
Magnesium chloride	0
Total incrusting solids	[2] 6.011
Nonincrusting solids:	
Sodium chloride	6.290
Sodium sulphate	5.290
Sodium nitrate	.894
Total nonincrusting solids	12.474

[1] 0.36 pounds per 1,000 gallons. [2] 0.86 pound per 1,000 gallons.

	Gr. per gal.
Loss on ignition (free CO_2)	.203
Organic matter	0
Total incrusting solids	6.011
Total solids	18.688

Analyzed by Dearborn Chemical Co.

Wells at Monteagle also produce water for the town. The analysis is as follows:

Analysis.

WELL NO. 5.

Incrusting solids (no nonincrusting solids):	Gr. per gal.
Iron and al. oxides	0.16
Silica	1.08
Calcium carbonate	0
Calcium sulphate	0
Calcium chloride	0
Calcium oxide	0.58
Sulphate radicle (SO_3)	1.00
Magnesium carbonate	0
Magnesium sulphate	0
Magnesium chloride	0
Magnesium oxide	0.15
Total incrusting solids	2.97
Loss on ignition (free CO_2)	0.75
Total solids	2.722

Bacterial analysis of this well water is as follows:

Total bacterial count on nutrient agar at room temperature, less than 20 per cubic centimeter.

Total bacterial count on nutrient agar at blood temperature, less than 20 per cubic centimeter.

Gas-forming bacteria on lactose bile, none.

Acid colonies on lactose litmus agar, none.

Indol reaction for *B. coli*, negative.

(Sample gathered Nov. 12, 1917.)

There is an abundance of water for all purposes for any size colony desired.

Fuel, coal, and hydroelectric power.—Fuel is available for all purposes. Coal is mined at numerous places on the plateau, and can be obtained cheaper in this section than any other section of the United States.

An analysis of a coking-coal mine at Rockwood, 40 miles distant, follows:

Analysis.[1]

Moisture	1.7
Volatile matter	29.3
Fixed carbon	60.1
Ash	8.9
Sulphur	.53
British thermal units	13.740

An analysis of coal from the Monterey branch of the Tennessee Central Railroad mined at Highland, Tenn., about 30 miles distant, is as follows:

Analysis.[1]

Moisture	3.0
Volatile matter	37.3
Fixed carbon	50.2
Ash	9.5
Sulphur	2.76
British thermal units	13.190

[1] Bull. 621–P, U. S. Geol. Survey, 1916.

Wood sufficient for burning in fireplaces and in cooking stoves is available and can be bought cheaply.

Hydroelectric power can be generated by several of the near-by streams if such installations are desired, or a branch line could be built from the main line of the Tennessee Power Co. where it crosses the plateau in Van Buren County, or from Sparta.

Labor.—Sufficient labor at reasonable rates can be secured for any work necessary to be done by outside parties. On the plateau common labor is now paid from $2 to $2.50 a day.

Railroad facilities and markets.—The main line of both the Nashville, Chattanooga & St. Louis Railway and the Tennessee Central Railroad crosses the Cumberland Plateau, the former in the southern part of the State, the latter farther north. Branch lines of both of these roads extend up and down the plateau making a large acreage of plateau lands contiguous to the railroad transportation. The Nashville, Chattanooga & St. Louis Railway is a part of the Louisville & Nashville system and its main line is the important connecting link in the through traffic line extending from Seattle, Wash., to Jacksonville, Fla., which was recently opened by the completion of the bridge across the Ohio River at Paducah, Ky. It is also a part of the through freight line from Chicago, Ill., to Jacksonville, Fla.

The Tennessee Central Railroad connects with the Southern Railway at Harriman, Tenn., and with the Illinois Central at Hopkinsville, Ky., and has freight hauling agreements with these two systems which permit economical and satisfactory handling of products originating in their territory.

These two railroads and their connections assure an efficient and satisfactory handling of all passenger and freight service which they may originate.

The Nashville, Chattanooga & St. Louis Railway and the Tennessee Central Railroad and their connections will reach the packing-house centers of Nashville, Louisville, Cincinnati, and Chicago; the grain and milling centers of Nashville and Chattanooga; the tobacco centers of Louisville and Lexington, Ky., and Clarksville, Tenn.; the produce centers of Chicago, Nashville, New Orleans, Savannah, and Florida points.

Natural resources of the plateau.—From a colony standpoint the natural resources of interest on the plateau are as follows:

Timber for all building purposes. The timber consists of oak (white, red, black, chestnut, scarlet, spanish, post, and blackjack), hickory, yellow poplar, blackgum, chestnut, maples, and hemlock. The majority of the stand is oak.

Coal as previously mentioned is nearby and available, but none is now being mined on the property that has been examined for soldier settlements.

Clay and shale suitable for manufacture of brick and tile occur at many places on the plateau.

A large limestone quarry is located at Crab Orchard, Cumberland County, which limestone is well suited for both road metal or agricultural lime when sufficiently pulverized. This limestone analyses over 95 per cent calcium carbonate and many of the layers show an analysis of 99 per cent calcium carbonate.

Building materials, road materials, and fuel are all near at hand and can be obtained cheaply and in large quantities that insure cheap prices for all construction work.

Natural resources adjacent to project examined.—The different natural products necessary for the success of a colonization project all occur in Tennessee in close proximity to the Cumberland Plateau.

Large deposits of phosphate rock occur in middle Tennessee in 150 miles of the plateau. This rock, which analyses as high as 80 per cent $Ca_3(PO_4)_2$, can be bought as raw ground phosphate or as acid phosphate from the large fertilizer companies in Nashville, Tenn.

Two large cement plants are located in Tennessee, one at the foot of the Cumberland Plateau at Richard City on the Nashville, Chattanooga & St. Louis Railway; the other at Kingsport, Tenn., on the Southern Railway. Both plants can ship direct to the proposed project.

Coal and coke have already been mentioned. There were over 7,000,000 tons of coal mined in 1918 in Tennessee and large quantities of coke were produced. Pig iron is made at the foot of the plateau at Rockwood in Cumberland County, adjoining. The iron ore and coal are both mined in several miles of the furnace. There are 24 iron furnaces in Tennessee. The manufacture of iron in Tennessee guarantees cheap iron products, such as farming implements, for any project.

Products that can be grown on suggested project when lime and phosphate are used.—At the present time the following products are being successfully grown on the plateau: Corn, grass and clover for hay, Irish potatoes, oats, soy beans, cowpeas, navy beans, sorghum, the common garden crops, such as cabbage, onions, and beets, and both large and small fruits of various kinds. Cattle and hogs are raised extensively. Some details of the agricultural value of this area are given in the report by the agronomist of the agricultural experiment station of the University of Tennessee. Mr. C. A. Mooers has had charge of the station's experimental work conducted in Cumberland County for the past 12 years.

Products now manufactured in Tennessee and available for colony use.—The essential manufactured products that are used by farmers should be produced nearby if they are to be obtained at the least cost. The following products necessary for a colony are manufactured in Tennessee within 150 miles of the plateau: Flour, cornmeal, cotton goods (especially overalls and socks), woolen goods, packing-house products, tobacco products, coffee, canned vegetables and fruits, sorghum, farm implements, harness, wagons, stoves, and tinware, fertilizer, cement, brick, lime, drainage tiles and sewer pipes, sashes, doors, and blinds, hardware, and shoes. In the east many families on the Cumberland Plateau produced everything they needed with the exception of salt and coffee. This is not possible now, but Tennessee settlers can now get practically every necessity they need from some Tennessee manufacturing plant. This means cheaper living conditions.

Comparative cost of development.—The initial cost of Cumberland Plateau land ($10 to $15 an acre) plus the cost of reclaiming, makes a total cost much less than the remaining Government land can be reclaimed for. The Nashville, Chattanooga & St. Louis Railway has cleared several areas on the plateau for demonstration farms and the cost of clearing this land completely and preparing for the first crop has been, according to Mr. Joe Judd, who had charge of the work, from $30 to $40 an acre. There are no fixed charges for water. Instead abundant water of the finest quality is available without cost. The building of improvements on unimproved land anywhere else in the United States would be much more expensive than in Tennessee, for in Tennessee all structural and road materials are near at hand and sufficient lumber is actually on the project that has been reported on; while in other sections some or all of the structural road materials have to be hauled to the project from a distant point, and these freight charges have to be borne by the project.

The central location of this project in respect to the markets of the United States will assure its financial success in the selling of its products at the top market price.

TENNESSEE SOLDIER SETTLEMENT BOARD,
WIN R. MANIN, *Chairman*,
WILBUR A. NELSON, *Secretary*.

TEXAS.

Gov. W. P. Hobby appointed a committee of five to represent Texas in the soldier settlement matter consisting of: Stewart R. Smith, chairman, Beaumont; R. H. Spencer, secretary, Houston; Senator A. C. Buchanan, Temple; Senator F. M. Gibson, Bonham; and J. H. Haile, vice chairman, San Antonio.

In addition the chambers of commerce in Beaumont, Houston, San Antonio, and Waco appointed committees which rendered great and deeply appreciated assistance in the investigations throughout the respective contiguous regions.

The total area figures for Texas are:

	Acres.
Land	167,935,000
In crop	25,340,000
Unimproved	85,000,000
Merchantable timber	4,000,000
Cutover land	12,000,000
Swamp land	1,240,000
Wet grazing land	1,000,000

Total number of farms, 450,000.

Texas is such a large State and has such a variety of soil, elevation, and climate that proportional figures have no significance. Even with but a little more than one-eighth the land area in crop last year (nevertheless) such figure is greater than for any State in the Union, and more than twice that for any in the southern district except Oklahoma, and the margin here is very small. Similarly the 2,240,000 acres of wet land is almost as large as that in North Carolina, or in Wisconsin, or in Michigan.

There are many opportunities for soldier settlement colonies of several types, so that the first step is selection of the type or types of project. This in turn requires a definite information as to the physiography and climate conditions of the State as a whole.

In the first place 100-foot contour extends back from the Gulf coast much as in the Atlantic coastal States. The distance increases from the southern tip, around toward Louisiana, varying from 25 to 100 miles. A considerable part of this strip averaging 30 miles wide, contains almost all the wet lands in the State.

The 500-foot contour passes through San Antonio, Austin, Corsicana, Terrell, and Paris. Between it and the 100-foot contour there is an area almost as large as South Carolina.

The Rocky Mountain Plateau extends into the western end so that the 2,000-foot contour runs along the dividing line between Oklahoma and Texas and extends almost due south through Big Spring to about 75 miles northwest of San Antonio, and then turns sharply west to the Rio Grande near the mouth of the Pecos. The northwest corner is nearly 5,000 feet above sea level, the westernmost tip—El Paso—nearly 4,000 feet, while a spur of the Rocky Mountain system extends down between the Pecos and the Rio Grande with peaks reaching to a maximum of 9,020 feet.

The mean elevation of Texas is 1,700 feet, or 200 feet more than West Virginia and 400 feet greater than Oklahoma.

Such topographical features in connection with the Gulf of Mexico produce wide precipitation differences. The southeast corner has 50 inches of rainfall, the southern tip—Brownsville—about 22 inches, El Paso 10 inches, the northwestern corner 18 inches, and the northeastern corner, Texarkana, 45 inches.

Thus it is that in the western quarter of the State—west of the one hundred and second meridian—and along the Rio Grande River, clear to the gulf, only irrigation colonies could be considered; next to the east, cattle ranching; next east of this, general agriculture based upon live stock and cotton; along the eastern edge, cut-over land projects for diversified farming, and along the coast as far west as the Colorado River, wet-land projects for general farming and trucking. The long and particularly early growing season of the low-lying lands in the southern tip is peculiarly favorable for trucking.

Areas of large land holdings which facilitate the blocking up of project opportunities are scattered all over the State.

In the face of these considerations, the final selection of a project or projects will depend upon the money available and, to a considerable extent, the recommendations of the Texas soldier-settlement committee. For this reason three of the many possible project opportunities will be described, selected solely as being fairly typical of the soldier-settlement project opportunities which the State offers.

The Medina project.—The San Antonio Chamber of Commerce suggests the advantages of taking over the stranded Medina projects—one of the late Dr. Pearson's enterprises. This project is located about 25 miles west of San Antonio and consists of 50,000 acres in a solid block, together with an almost completed comprehensive, high-class irrigation system, including an artificial storage reservoir of 252,000 acre-feet capacity. The enterprise has proven a disastrous financial failure, chiefly because three years out of five good crops can be raised without irrigation. For the past five years everything has been tied up in litigation. The bondholders are almost entirely strong Scottish and Canadian interests and it is suggested they would probably turn over the whole property for but a fraction of its cost or join with the Federal Government on any at all reasonable basis in making all the land a soldier settlement.

If advantageous terms were offered by the owners, they would merit consideration. A very little time, and relatively small additional expense, would be required to make all the land into going-concern farms—doubtless, considerably less time than any other soldier-settlement project in the entire Nation. The final cost to the soldier settlers would be low, both actually and in comparison with the net earnings per first cost of allotments—that is, with any offerings of owners low enough to be seriously considered. Unless the State of Texas or the Federal Government does something of the kind the project will be a seriously deterrent influence against irrigation in similar territory of the State, whereas the advantages of artificial watering are hereabouts real. The location with respect to transportation and a large city—San Antonio now has a population of 225,000—is excellent.

About the only serious objection is that relatively little soldier labor would be employed in preparing the going-concern farm homes for soldiers.

Referring now to the essential details of the project, it is located in Medina, Bexar, and Atascosca Counties, from 13 to 30 miles from San Antonio, and is traversed by the main lines of the Southern Pacific and the International & Great Northern railroads. The towns of Macedonia, La Coste, Lytle, Natalia, and Devine are on these lines.

Most of the land is undulating to rolling, some is level, and some little almost rough. The entire elevation is above that of San Antonio, which is 650 feet above sea level. As a rule, the soils are sandy loams, some reddish but mostly black, with a splendid subsoil. In 1904 the United States Bureau of Soils made a survey of the San Antonio area which includes this region.

The mean annual temperature is 69.4°, with a maximum of 108° and a minimum of 14°. The average date of the first killing frost is November 19 and of the last March 10, giving a growing season of over eight months. The annual precipitation varies greatly, but the mean is reported at 28 inches. The whole region is semiarid.

No overtures have been made by the owners, so the price for either the project as it stands or on a net acreage basis can not be given.

Reclamation would be deferred maintenance upon the main canals and laterals, completing the sublaterals, constructing some drainage, a little clearing, land leveling, road building, preparation of seed beds, and planting crops.

The cost of going-concern farms would be about $125 an acre.

Houston project.—The second project to be described is the Houston project, located in Harris County, from 10 to 30 miles from Houston—a city of 170,000 people. This area is traversed by four railroads—the International & Great Northern, the Houston & Texas Central, the Missouri, Kansas & Texas, and the Trinity & Brazos Valley railroads. No part of the land is more than 4 or 5 miles from a railroad station. Excellent macadamized roads lead out in all directions from Houston.

The land surface is from level to gently rolling, at an elevation of from 75 to 150 feet above sea level. The soil is a dark sandy loam with a red to yellow clay subsoil. The principal crops are cotton, corn, potatoes, peanuts, and vegetables. There is practically no timber on the land. The poultry and dairying industries are very profitable in this locality. The United States Bureau of Soils has made no survey of Harris County, but surveys were made of Lavoca County (1905), the Brazoria area (1902), and Washington County (1913).

This area is under the Gulf breeze which tempers the heat of the summer. The mean annual temperature is 68.8°, with a maximum of 108° and a minimum of 6°. The average date of the first killing frost is November 25 and of the last February 20, thus giving a long growing season of 278 days. The mean annual precipitation is about 48 inches and is generally well distributed.

An abundant quantity of fine soft water is found at a depth of from 25 to 50 feet. Artesian flow is found at a depth of from 400 to 1,500 feet.

This land has been offered in large tracts at an average price of $30 per acre.

The reclamation work would consist of drainage, clearing, addition to the soil of lime and phosphate, and road building. A going-concern farm would cost not more than $100 per acre, of $10,000,000 for a 100,000-acre colony.

Neches project.—The third project opportunity to be described, the Neches project, is located in Orange and Jasper Counties, on the east bank of the Neches River, about 13 miles from the city of Beaumont, a place with a population of 40,000. This city has six railroads, but two of which actually cross our tract—the Galveston, Beaumont & Northeastern and the Kansas City Southern Railroads.

The topography is from level to gently rolling, with an elevation of 15 feet and more above sea level. The soil is a sandy loam averaging about 10 inches deep and underlain by red clay subsoil that varies to yellow. The usual "piney-land" crops are grown, and the timber consists of both long and short leaf pine, gum, oak, hickory, beech, ash, and some cypress. No surveys have been made of this area by the United States Bureau of Soils, but in 1903 such a survey was made of the Woodville area and in 1913 of the Jefferson County area.

The climate is humid. The temperature varies from 20° to something over 100°. Killing frosts are probable from November to March, which gives a long growing season of about eight months. The mean annual precipitation is about 60 inches and is particularly unseasonable.

This land in very large tracts has been offered at a price of $12.50 per acre.

The reclamation work would consist of extensive drainage, clearing, mosquito prevention, road building, and the addition to the soil of lime, phosphate, and nitrate of soda.

The cost per acre of a "going-concern farm" would be not more than $100 per acre.

BEAUMONT, TEX., *May 21, 1919.*

HON. FRANKLIN K. LANE,
Secretary of Interior.

DEAR SIR: The Soldiers' Settlement Board of Texas, appointed by the governor of Texas for the purpose, among other things connected with the activities of this State in such matters, to represent the State in cooperating with the Federal Government in the soldiers' settlement program, has assembled and conferred since receiving the report of your department proposed to be laid before Congress with reference particularly to Texas, and we have to report that it is the sense of this board that we have carefully considered the draft of the proposed report by your department and have become advised as far as possible as to the correctness of the statements therein, and we approve and indorse said report in its entirety except the portions thereof under the head respectively of the "Medina project," "Houston project" and "Neches project."

In so far as such projects are specifically mentioned for the purpose of showing that there are concrete propositions ready to be handled and to show a variety of selection by giving the general characteristics of the projects merely as illustrations of what can be procured in our State, we indorse the mentioning of the specific projects, but we think some of the statements made with reference to each of them have the effect of instituting comparisons on the merits of the projects, and to this extent we do not agree with this part of the report, and we think that no such comparisons should be insituted, directly or indirectly, with reference to any projects prior to the appropriation by Congress and the lodging of the duty of selection with proper authorities designated for that purpose. We are advised that there are other projects in each of the vicinities mentioned where the specific projects named are located with similar merits and surrounded by similar conditions, affording variety for selection in each vicinity. Besides, there are other portions of Texas not mentioned where may be found suitable selections and some which have characteristics which might appeal to the taste and judgment of individual purchasers more strongly than any of the projects specifically named in the report.

Our belief is that it will probably be found to the best interest of the purchasing class, as well as to our State at large, that there should be projects located in at least four general sections of the State where lands are available in bodies as required; viz, northeast Texas (the Texarkana section), southeast Texas (the Houston and Beaumont sections), south central Texas (the San Antonio section), and west Texas. Then there are marsh-land projects which we think will be found feasible, and which have been on some parts of the coast already demonstrated to be feasible.

The point made by our board is that these things should be left, as largely as possible, to the consideration of the properly constituted authorities after the appropriations have been made and the general plan erected by Congress and worked out by your department.

We also wish unqualifiedly to indorse the bill, preliminary plan of which is in our hands, prepared by Mr. Mondell, and which is to be introduced at this session of Congress, and to earnestly urge its speedy passage.

Respectfully submitted.

SOLDIERS' SETTLEMENT BOARD OF TEXAS,
By STUART R. SMITH, *Chairman.*

VIRGINIA.

The committee representing the Commonwealth of Virginia in the soldier settlement matter as appointed by Gov. J. Westmoreland Davis consists of T. W. Carrington, chairman, Richmond; John C.

Easley, secretary, Richmond; Oliver J. Sands, Richmond; I. Walke Truxton, Norfolk; Tench F. Tilghman, Norfolk; A. B. Schwarzkopf, Norfolk; Walter Edward Harris, Petersburg; D. S. Jones, Newport News; Lee Long, Cante; J. William Ridley, Courtland; J. E. Nottingham, jr., Franktown; A. T. Moore, Staunton; A. E. Anderson, Bristol; John F. Kolar, Disputanta; and W. P. Warren, Bacons Castle.

The total area figures for Virginia are:

	Acres.
Land	25,768,000
In crop	5,577,000
Unimproved in farms	10,000,000
Merchantable timber	4,850,000
Cut-over land	10,000,000
Swamp land	600,000
Overflow land	200,000

Number of farms, 195,000.

That is to say that the amount of wet land is relatively small in spite of the famous Dismal Swamp being in considerable part of Virginia; two-fifths is cut-over land and but a little over one-fifth in crop last year. This small proportion of cultivated land is particularly interesting in view of the fact that the history of the United States begins with the landing of Capt. Christopher Newport and his little band of colonists at Jamestown, Va., May 13, 1607, and that from that day to this the Old Dominion has left its work on every page of American history.

Virginia consists of five physiographic divisions—tidewater Virginia, middle Virginia, Piedmont region, Valley of Virginia, and southwest Virginia or Appalachia. The first consists of the level lands along the Atlantic and Chesapeake Bay coasts and the broad estuaries of the rivers emptying into the ocean and bay. Roughly speaking it is the region east of a north and south line through Richmond and includes the two countries south of the Eastern Shore of Maryland and east of Chesapeake Bay. Middle Virginia is the strip next in land running clear across the State and generally speaking lies between the 150 and 500 foot contours. It varies from 25 to 100 miles in width. The Piedmont region extends from middle Virginia to the Blue Ridge and consists of a diversified country with considerable areas of level land in some parts and in others it is rolling or broken by spurs from the Blue Ridge into alternate mountain ranges and valleys.

The Valley of Virginia lies between the Blue Ridge and the Shenandoah and North Mountain Range of the Alleghanies and is watered by the Shenandoah River system. Its agricultural adaptation is strikingly similar to that of the Piedmont region. Southwest Virginia or Appalachia is the mountainous coal and mineral section of the Old Dominion, but its maney valleys, hills, and mountain sides are usually covered with fertile soil. The live-stock industry predominates and sheep raising is increasing rapidly.

Because of such a large proportion of agriculturally undeveloped land, variety of physiographic features, and large industrial centers, there is an embarrassing wealth of project opportunities for soldier settlements. Draining and reclaiming the world-famed Dismal Swamp perhaps first suggests itself. Possibly next comes to mind

the appeal of blue-grass Appalachia for cattle-breeding and sheep-raising colonies such as suggested in southeastern Kentucky and West Virginia. The Virginia Piedmont and the Shenandoah follow in the minds of almost every American, and there are no doubt attractive project opportunities scattered over these.

As a matter of fact, the Virginia soldier-settlement committee was appointed too late—February, 1919—to cooperate in the preliminary investigations, and these were largely confined to middle Virginia. Here the project opportunities are of the "abandoned-land" type, duplicating quite closely those described in Maryland.

It is often said the South lost its vision at Appomattox, but it is truer that it lost its agricultural man power in the war. Throughout the wonderful middle Virginia most of the land was sold for taxes and nearly all "went back." Before the region began to recover, the trend of the city caught it. Not a few cross currents came into play. The final result is that the naturally fertile but "worn out" and "abandoned" middle Virginia can be gathered together in large blocks, and close to Richmond, for an average price of less than $25 an acre. Of such land there is an area of at least 2,000,000 acres, a considerable part of which has been examined in a preliminary way. In the Piedmont and middle Virginia there are 10,000,000 acres of idle farm land.

Amelia project.—As a concrete example of a middle Virginia soldier settlement, and quite a typical one, the Amelia project will be described. It is located 30 miles southwest of Richmond, in Chesterfield and Amelia Counties, between the main lines of the Southern and the Norfolk & Western Railroads. No land is over 12 miles from a railroad.

The elevation varies from 200 to 350 feet above sea level. The principal streams which cross middle Virginia generally flow northwest to southeast, so that the country is a succession of ridges and valleys affording excellent natural drainage. The valleys are often narrow and fairly deep, but the ridges are not very prominent and usually broad gently rolling table-land. The soil is that of the coastal plain, light sandy loams. Corn, wheat, oats, peanuts, and tobacco are principally grown. In 1901 the United States Bureau of Soils made a survey of the Prince Edward area, adjoining portions of Chesterfield and Amelia Counties, and in 1906 such a survey was made of Chesterfield County itself.

The climate is desirable and healthful, and quite well suited to agriculture. Summers and winters are both comparatively mild, with a mean temperature of about 74° and 40°, respectively, a maximum of 102° and minimum of 3° below zero. The first killing frost usually occurs around November 1, and the last one about April 2, giving a long growing season of about seven months. The mean annual precipitation is between 42 and 47 inches.

There are a large number of interests represented in this area and the tracts are of varying size, but a colony of 100,000 acres could easily be gotten together at an average price of $20 per acre.

The reclamation work would consist of a little drainage, clearing, road building, addition to the soil of lime and some potash, planting of legumes to increase nitrogen, and soil rebuilding generally. "Going-concern farms" could be had at an outside cost of $125 per acre, or $10,000,000 for an 80,000-acre farm.

Splendid demonstrations of the region's adaption to agricultural pursuits may be seen in the farms here and there, generally "brought back" by newcomers from the Middle West.

Present conditions of the State of Virginia, in reference to farming, submitted by the committee appointed by Gov. J. Westmoreland Davis on the matter of the soldiers' settlement:

The statistical status of our State as to total land is as follows:	Acres.
Land	25,768,000
In crop	5,577,000
Unimproved in farms	10,000,000
Merchantable timber	4,850,000
Cut-over land	10,000,000
Swamp land	600,000
Overflow land	200,000

Number of farms, 195,000.

Its agricultural, trucking, forest, and mineral production in 1917, as compared with 1912, is as follows:

	Increase, 1912 to 1917.	Value.
	Per cent.	
Corn	25	$150,000,000
Wheat	8	36,000,000
Tobacco	10	40,000,000
Hay	20	30,000,000
Potatoes	10	20,000,000
Peanuts	4	11,000,000
Apples	35	10,000,000
Other products		10,000,000
Total		307,000,000
In 1917:		
Horses, hogs, cattle		32,000,000
Forest products		35,000,000
Trucking		15,000,000
Poultry and eggs		13,000,000
Total		402,000,000

It is further shown by the above comparative statement that in previous years the value and improvement in farming in the State has been most pronounced. Up to 1912, without any more land being cultivated or any more laborers being employed, the value in round numbers of the crops, farm dwellings, and barns, had increased during the past 10 years prior to 1912 over 100 per cent. This shows most conclusively the great opportunities that await the intelligent farmers in our State.

This State is divided into five physiographic parts:

1. The tidewater section, extending along the Chesapeake Bay and Atlantic Ocean up into the stretches of the Potomac, York, and James Rivers and their tributaries. This country is particularly adapted to trucking, and its fish and oyster industries are of tremendous value. In addition to trucking, the regular farming crops of corn, oats, peanuts, and wheat are raised. Wherever these sections are conveniently located as to transportation, the land values are well up and compare most favorably with the lands of other States similarly situated.

2. The Valley of Virginia, which is particularly adapted to wheat, corn, and cattle, and here is located the Virginia apple section, and the value of these lands is fully appreciated and but few if any farms are available.

3. Southwest Virginia, taking in the great mineral part of our State, iron and coal, and also in this section cattle raising is done on a very large scale. This part of the country is better adapted to this industry than to homelike farming.

4. The Piedmont region is that section of the country, as the name indicates, at the foot of the mountains, and is most adaptable to fruits, grain, and stock raising, and the value of these lands is well sustained and is not very easily available in very large quantities.

5. Middle Virginia, practically most of which lies south of the Potomac River to the James, and a large section of the country south of James River to the North Carolina border, is where the great opportunity for development has been and still exists to the greatest extent. These lands were largely used, prior to the War Between the States, in production by the availability of numbers of farm laborers. The end of the Civil War found the land owners with large tracts with but few laborers to cultivate same, resulting in but a small percentage of this part of the country being put under cultivation. This part of the country, though, in these years of uncultivation, has produced a large growth of second-growth pine, which has not only preserved the land but has been a source of supply to lumber dealers and of revenue to the owners of many million feet of timber and many millions of dollars. This part of the country has demonstrated most wonderfully and decidedly the results of intelligent and intensive farming, and there is hardly a neighborhood in which there is not some forehanded farmer who has demonstrated in the most practicable manner that these lands can and do pay to farm.

They need but intelligent fertilization for a year or two for the soil to be brought up to a remunerative state of production. From the viewpoint of many comforts of a home there is nowhere in the country that surpasses this part of Virginia. It has a mean temperature of 74¼° and a maximum of 102° in particularly heated summers and rarely ever goes below zero in the winter. The first killing frost occurs around November 1 and the last one about April 1, giving a long growing season, and there is scarcely a month in which plowing and cultivation can not be done. The mean annual precipitation is between 42 and 47 inches. This section of the State is particularly well watered, and especially on the south side of James River the drinking water is unsurpassed and the springs are both numerous and prodigal. There is hardly a known vegetable or fruit that can not be grown, and on every place there is sufficient firewood and timber for home consumption without hardly missing it.

It is these lands, as compared to other values in other parts of the State and as compared to values in other States, certainly of North and South Carolina, that are cheap. The value of this property has increased gradually but most pronouncedly in the past 20 years, and few, if any, farms can be had now for less than $20 to $30 per acre, and then only where the property is really for sale. At the same time these values are exceedingly low as compared to other States. In this section no drainage of swamps and but in a small way will stump pulling be necessary.

The leading crops produced are corn, wheat, oats, tobacco, peanuts, hay, especially alfalfa, and fruits of all kinds, the leading of which are apples, peaches, plums, pears, apricots, and berries, such as strawberries, raspberries, blackberries, etc.

The soil varies from a sandy loam to a heavy clay, thus furnishing opportunities for all kinds of farming and stock raising.

Through this middle and south-side section of the country there are many tracts of land that are available. There is nowhere in the settled portion of the United States where larger tracts can be obtained at so reasonable prices, with sufficient number of railroads running through to always have a nearby depot or good roads to some closely situated city.

The opportunity for our Government to work the plan now being considered to enable the soldier who wishes a farm to procure a real home, offering the most opportunities for the welfare of country life, is unsurpassed in this section of our State, and the committee in charge will loan every assistance to the Government's representatives in acquiring such land as may be best fitted for the purpose intended for its use; that is, to give the soldier a good home with all the best surroundings of every kind.

T. W. CARRINGTON, *Chairman.*

WEST VIRGINIA.

The preliminary investigations were made in this State prior to the appointment, April, 1919, by Gov. John J. Cornwell of a soldier-settlement committee consisting of: J. B. McLaughlin, Strange Creek; Merritt Wilson, Elkins; and Howard Gore, Clarksburg.

The total area figures for West Virginia are:

	Acres.
Land	15,375,000
In crop	2,350,000
Unimproved in farms	4,500,000
Merchantable timber	1,400,000
Cut-over land	4,650,000
Swamp land	0
Overflow land	25,000

Total number of farms, 100,000.

In spite of the State being largely mountainous, its agricultural development is quite high, hardly exceeded in any State of the Union. For instance, almost 80 per cent of the land is farmed by owners.

With the exception of the two valleys, each containing less than 15,000 acres, no diversified-farming project opportunities were uncovered; that is, of course, taking into account development, size of holdings, price of land, etc. Indeed, probably more farms are too small than too large, considered from a diversified-agriculture point of view. In any event, the delimitation of rural settlements was, generally speaking, made by nature in the form of topography—natural lines of communications and barriers or community boundaries. There are also practically no wet lands, but there are 2,500,000 acres of cut-over and mountainous land held in tracts larger than 10,000 acres and up to 140,000 acres. Most of these large holdings were collected for timber, coal, and oil, and the surfaces of many are quite idle.

The surface rights of these lands can be secured at from $2.50 to $4 per acre. The smaller part, but nevertheless a large total, is in limestone and blue-grass regions, and the conditions are favorable for cattle-breeding colonies like those described in southeastern Kentucky. Indeed, southwestern Virginia, southeastern Kentucky, and southwestern West Virginia are essentially one mountainous area.

Taking into account the interspersed holdings of less than 10,000 acres which could be blocked up with the larger tracts, there are easily 500,000 acres from which to choose a project or projects featuring live-stock production—"horseback farming" with a minimum of cultivation to furnish winter feed.

It is rather futile to outline any really definite project or decide upon preparing two or more until the amount of money allotted for West Virginia be known. The map indicates the general area within which the most attractive opportunities will probably be found.

This southwestern portion of the State has most excellent water and railway transportation facilities. The Chesapeake & Ohio Railroad, double tracked, connects with eastern, western, and northern points; the Baltimore & Ohio runs to northern markets; the Norfolk & Western connects with southern points; and branch lines of all of these roads are scattered throughout the region. Water transportation is chiefly on the Ohio River. Huntington, with a population of 31,164 (1910 census), is the principal city.

In 1913 a survey was made of Boone, Logan, and Mingo Counties by the United States Bureau of Soils, and in 1911 such a survey was made of the Huntington area, including Cabell, Lincoln, and Wayne Counties. According to these surveys, the soils divide themselves into three general groups—uplands, where the soil is residual; terrace, with old alluvial soil; and first bottoms, of recent alluvial soil. These are all silt or sandy loams. The principal crops are corn, tobacco, wheat, oats, hay, and potatoes. A great deal of this land is in forests, but most of it has been cut over. Lumber is easily rafted down the rivers to markets.

The land surface is decidedly rough and broken and the bottom lands quite narrow. The elevation in the southern portion is from 500 to 1,500 feet, and farther toward the north from 1,000 to 1,800 feet above sea level. The extremes are from 490 to a maximum of 3,300 feet. The general drainage is into the Ohio, the Coal, the Little Coal, and the Guyandot Rivers.

The climate is an agreeable one, with short, hot summers and cold, open winters. Temperatures above 100° and below zero are rare, the mean summer temperature being about 74° with a maximum of 102°, and the mean winter temperature about 35° with a minimum of 26° below zero. The first killing frost is not expected before September 18 or 20 or after April 15 or 20, thus giving a growing season of about six months. The mean annual precipitation is from 37 to about 47 inches and is distributed in such a way as to be most beneficial to growing crop—that is, heaviest during the growing season and lightest during the harvesting season. In general, the climate is exceedingly well adapted to diversified farming, stock raising, and dairying.

Surface rights on this land could be purchased for from $2.50 to $4.50 per acre.

The reclamation work would consist largely of some drainage, clearing, preparation of seed beds, road building, pasturage, improvement, etc.

The cost per acre of a "going-concern farm" would, in this region, be about $80, which is two-thirds as great as in cut-over land and drainage projects in the other States. A larger portion of the investment would be in live stock. One hundred and twenty-five thousand acres of such a farm would, therefore, cost not more than $10,000,000.

MAY 15, 1919.

H. T. CORY,
Consulting Engineer, United States Reclamation Service,
Washington, D. C.

DEAR SIR: At the request of the Hon. John J. Cornwell, governor of West Virginia, we are inclosing a brief statement about farming conditions and opportunities in this State, based on our personal observation and knowledge and on the advice of the director of extension and professor of farm management at the college of agriculture, with whom we conferred.

We are also stating our opinions relative to the kind and amount of Government aid that should be given to returning soldiers as aids to them in settling on the land.

Our report is necessarily a preliminary one, based on general information. We shall be glad to supplement it later with answers to any questions suggested by Members of Congress, or members of our committee will be glad to appear before congressional committees that may be having hearings on this question.

Trusting that our information will be of service in presenting to Congress the needs of the returning soldiers,

Very truly, yours,

J. B. McLaughlin, *Strange Creek, W. Va.*,
Merritt D. Wilson, *Elkins, W. Va.*,
Howard M. Gore, *Clarksburg, W. Va.*,
Committee.
Nat T. Frame, *Morgantown,*
Director Agricultural Extension.
A. J. Dadisman, *Morgantown,*
Professor Farm Management.

Report on Soldier Settlement—Opportunities and Needs in West Virginia.

(*a*) *Agricultural sections of West Virginia.*—The eastern panhandle, including the Shenandoah, Potomac, and South Branch Valleys. Apple and peach orchards, grain farming, dairying, and cattle raising are the prevailing types of farming. In the eastern panhandle large orchard companies and individual growers employ many farm laborers, especially in picking season. Grain farming is done in part by tenants on a share rental. Capitalists find frequent opportunities for investments in orchards. Tenants who have acquired a few thousand dollars of capital are constantly becoming farm owners.

(*b*) *The Appalachian Plateau.*—The grazing of beef cattle and sheep, the production of crops including potatoes and buckwheat, together with large areas of forests and cut-over lands, typify this section. In the Appalachian Plateau cattle and sheep grazed in the mountain pastures are brought down to the valley farms for wintering, sometimes a distance of several miles. Lumbering still offers opportunities for winter work. Settlements by farmers in cut-over timberlands have been retarded because such lands have been held in large boundaries.

(*c*) *Central blue-grass region.*—The production of beef cattle and sheep is the dominant type of farming. In the central blue-grass section the small areas of level land in ridges and in bottoms are intensively cropped for winter feed to carry the live stock for grazing the hillside pastures. Most farmers own and operate their own farms. Many farmers receive oil and gas royalties.

(*d*) *Ohio Valley.*—Dairying, market gardening, and general farming, including live stock, are practiced. In the Ohio Valley the farming is more varied in type, with some tenantry, some hired farm managers, some large bottom-land farms under personal management.

(*e*) *Southern Coal Fields Region.*—Intensive farming is done to supply local markets, and cattle are grazed in lands farther back. In the coal-lands section the attractions of the industries and "public works" and the ownership by coal companies of large surface areas have tended to minimize the interest in farming, and at the same time to create excellent opportunities for those who do successful farming.

Opportunities for Colonization.

In the Appalachian Plateau section are several large areas of cut-over lands suitable for subdivision into live-stock farms of from 150 to 200 acres. The present prices of those lands for complete boundaries run from $2 to $10, the prevailing price being $5 and $6 per acre. The cost of clearing will be around $30 per acre. There might also be available some muck land suitable for potatoes, cabbage, etc., at higher prices than above.

In the Central and Ohio Valley sections are some tracts, in cases partially cleared, large enough for colonization, and other combinations of tracts can be made to provide for colonies of general and live-stock farms. Some of these are near established roads and settled communities. Prices will vary from $5 to $20 per acre.

In the southern section are surface tracts owned by coal companies well located for colonies of intensive farmers to supply the coal camps with produce, fruit, milk, etc.

PRESENT TENDENCIES IN WEST VIRGINIA AGRICULTURE.

There is a marked tendency in nearly all sections of the State toward better farming, such as better crop rotations, better use of fertilizers, better breeding and management of live stock. Coupled with this is a growing appreciation of country life and all it means. Practically inexhaustible supplies of natural gas, coal, and oil, with steady local markets, increasing mileage of hard roads, beautiful scenery and moderate climate and other factors are helps to make country life in West Virginia satisfying. Several hundred community clubs with broad educational plans for community betterment are combined into many active farm bureaus which cooperate with the college of agriculture and the United States Department of Agriculture in supporting well-trained county agents and home demonstrating agents. In general, the outlook of West Virginia farmers at the present time is distinctly opimistic.

Here and there throughout the State are desirable farms, well located in good settled communities, that are for sale because of deaths and other causes, and also because of the shortage of farm laborers willing to work as tenants or "hands" at the wages offered by owners who lack the initiative or capital to make better terms possible. Some of these farms are being purchased by tenants, some by farmers from rougher sections who have acquired capital from sales of mineral rights, and some by returning soldiers who are sons of property owners in the same section.

There are in most sections soldiers with actual farm experience who are desirous of owning farms of their own and ready to operate them themselves under improved methods with which they have now become familiar. Some of these soldiers are prepared to finance themselves in part, but many have no resources other than knowledge of farming, good health, and ambition.

RECOMMENDATIONS.

In view of the conditions briefly sketched above, we recommend:

First. That the Federal Government provide some form of aid which will make directly and immediately available to returned soldiers all help necessary for the purchase and equipment of cleared or partly cleared farms for immediate use. Desirable farms in the State are offered for sale at the present time at prices not in excess of the cost of preparting cut-over lands for actual farming.

The returned soldiers who are interested in farming are ready to begin farming now and need immediate aid. For this purpose a Federal appropriation of $5,000,000 is recommended to be immediately available without reference to State aid.

Second. In conformity with the proposed plan of Federal and State cooperation, that Federal aid be provided for the colonization of returned soldiers. There are at least 25 areas with approximately 500,000 acres in the State which are suitable for colonization by returned soldiers for general and grazing farms. Each area is large enough for suitable farms for from 50 to 150 farmers when cleared and properly fitted for settlement. For this purpose an appropriation of $5,000,000 is recommended to be available for developing the farms which the State legislature of 1921 may make appropriations to purchase.

This makes an appropriation totaling $10,000,000 for soldier settlements in West Virginia.

PART III.

REPORT ON INVESTIGATIONS OF LANDS NEEDING DRAINAGE AND CUT-OVER LANDS IN THE NORTHERN DIVISION AND CUT-OVER LANDS IN THE WESTERN DIVISION.

By F. W. HANNA, Consulting Engineer.

LAND NEEDING DRAINAGE AND CUT-OVER LANDS IN NORTHERN DIVISION AND CUT-OVER LANDS IN WESTERN DIVISION.

GENERAL INTRODUCTORY STATEMENT.

1. *Opportunities for projects in northern division.*—The northern division presents numerous attractive soldier-settlement possibilities on reclaimed cut-over lands and lands needing drainage, the preliminary investigation disclosing one or more feasible projects in practically every State. These projects range in size from 5,000 acres upward, and in the aggregate comprise 11,413,000 acres. Some of them are described later on in this report in detail by States, following a brief discussion of the preliminary investigation, of general soil conditions, and of methods of reclamation in the division as a whole.

2. *Boundaries of northern division.*—The territory here designated as the northern division of the lands needing drainage and the cut-over lands investigated under the appropriation act of Congress of July 1, 1919, comprises that portion of the United States lying east of the ninety-eighth meridian and north of the southern boundaries of Kansas and Missouri and of the Ohio River and Mason and Dixon line. The division therefore includes the States of Connecticut, Illinois, Indiana, Iowa, Maine, Massachusetts, Michigan, Minnesota, Missouri, New Hampshire, New Jersey, New York, Ohio, Pennsylvania, Rhode Island, Wisconsin, and Vermont, and portions of the States of Kansas, Nebraska, North Dakota, and South Dakota. To this territory there were added the investigations of the cut-over lands in California, Idaho, Montana, Oregon, and Washington in the western division.

3. *Soils of northern division.*—The boundaries of the northern division not only inclose all of the glaciated regions of the United States, but almost all of this division has been affected by glacial action. Large areas in the Pacific Northwest, in the vicinity of Puget Sound and in eastern Washington and northern Idaho, have been invaded by glaciers. The glaciated parts of the country comprise the glacial and loessial soil province, which is the largest and most important soil group in the United States. In this group are found the Carrington series, embodying the great prairie wheat belt of Minnesota and the Dakotas; the Marshall series, comprising the unexcelled prairie corn belt of Nebraska, Iowa, and Illinois; the Miami series, embracing the splendid small-grain, grass, and fruit sections of Wisconsin, Michigan, Indiana, and Ohio; and the Volusia series, embodying the productive soils on the northern and western slopes of the Allegheny Mountains in New York, Pennsylvania, and Ohio. The glaciated regions also contain the glacial lake and river terrace soil province, to which belong the Fargo soil series of Red

River Valley, famous for its small-grain and potato production, and the Superior, Clyde, and Dunkirk series around the shores of the Great Lakes, well known for their adaptability to the growing of small grains, grasses, vegetables, and fruits. A very large percentage of the peat soils of the United States is also situated within the boundaries of the northern division.

4. *Purpose of investigations.*—The purpose of the investigations herein reported is the examination of unused lands needing drainage and unused cut-over lands and the selection therefrom of areas suitable for agricultural development for homes for soldiers, sailors, and marines. In this selection not only agricultural fitness of the land had to be considered but the discovery of reasonably compact tracts of suitable size for economical communities had to be made. It was assumed that these communities must be large enough to make cooperative purchasing of supplies and selling of products and Government supervision economically feasible.

5. *Plan of investigations.*—Owing to the large area to be covered by the investigations and to the limited time and funds available for making them, actual field examination had to be reduced to a minimum and existing records relied upon and utilized to the fullest extent. National and State agencies were first consulted for such data as they were able to furnish and then county agencies were called upon to supplement the information thus secured. So far as practicable, the data obtained from these two sources were then supplemented with field examinations on some of the most promising areas in the various States. By following this plan it is believed that a maximum amount of information has been secured with a minimum expenditure of time and money.

6. *Relation of personnel to investigations.*—In making investigations in the northern division the general supervision of all the work was in charge of F. W. Hanna, consulting engineer. The field work on the lands needing drainage has been mainly done by P. M. Fogg, engineer, in North Dakota, South Dakota, Minnesota, and Iowa; by E. I. Davis, engineer, in Kansas and Missouri; by H. J. Gault, engineer, in eastern Wisconsin, Illinois, Michigan, Indiana, and Ohio; and by A. D. Morehouse, engineer, in western Wisconsin, New York, Pennsylvania, New Jersey, and the New England States. The field work on cut-over lands has been done by W. H. Graves, irrigation engineer, in Washington, Oregon, California, Idaho, and Montana; by F. H. Murray, land expert, in Minnesota, Wisconsin, Michigan, and Missouri; and by A. D. Morehouse, engineer, in all of the States above named in which he investigated the lands needing drainage, except Wisconsin. A portion of the field work in the investigations of the lands needing drainage and of the cut-over lands was done by F. W. Hanna, consulting engineer.

7. *Acknowledgments.*—In securing the data for this report courteous, valuable, and extensive assistance has been given from numerous public and private sources, for which appreciation is here expressed. While it is impracticable to name specifically all sources of assistance, special thanks are due to the United States Forest Service at Washington, D. C., Helena and Missoula, Mont., and Portland, Oreg.; to the United States Bureau of Public Roads and Rural Engineering at Washington, D. C.; to the United States Railroad Administration at Washington, D. C., and elsewhere; to the various

State colleges and universities; to the various State departments of agriculture; to numerous other State and county officers; and to the State cooperative committees appointed by the governors.

8. *Cause of swamp lands.*—Practically all of the swamp lands in the northern division are due to glacial action. Five different advances of large ice sheets, known technically as the Albertan, Kansas, Illinoisan, Iowan, and Wisconsin glaciers, each widely separated from one another in time, are supposed to have descended from higher lands in Canada into the United States, each leaving large accumulations of glacial drift consisting of fragments of rock ground into various degrees of fineness. The different drift sheets in some cases cover partially new areas and in other places overtop one another. The combined area formed by these various ice sheets covers practically all of the area east and north of the Missouri River and north of the Ohio River, including in addition thereto New York and the New England States, as well as small areas beyond these limits. The glacial drift deposits vary from a few feet up to several hundred feet in depth and they obviously have had a marked influence on the soil, topography, and drainage conditions of the glaciated area.

9. *Location of present swamp lands.*—Undoubtedly all of the glaciated areas, as originally left abounded in undrained depressions and pockets. The drift deposits were no sooner made, however, than precipitation, weathering, and erosion began to establish natural drainage outlets and thus to eradicate the undrained depressions. So long has been the time through which these drainage agencies have acted and so complete has been their work that natural drainage outlets have been established for practically all of the original depressions in all of the glacial-drift sheets except the last—the Wisconsin glacial sheet. This sheet covers all of North and South Dakota east of the Missouri River, practically all of Minnesota, Wisconsin, Michigan, New York, and the New England States, and large areas in north central Iowa, northeastern Illinois, northern Indiana, and northern Ohio. It is therefore within these States and the portions thereof mentioned that the principal glacial swamp areas of the United States exist. If North Dakota had a large annual rainfall, it would be one of the large swamp-land States of the country. Its semiarid climate has deprived it of this distinction.

10. *Classification of swamp areas.*—The swamp areas found within the Wisconsin drift sheet may be logically classed into three groups: (*a*) Till-plain swamps, formed on the flat till-plain areas of the glacial drift; (*b*) morainic swamps, formed within the morainic and intermorainic mounds of the glacial drift; and (*c*) glacial-lake swamps, formed by temporary lakes in front of retiring ice sheets as they melted. The till-plain swamps as a class are shallow and have shallow peaty or mucky soils, with sandy to clay subsoils. The morainic swamps more often abound in deep, small depressions, and quite often have deep peat soils, with stony or sandy subsoils. The glacial-lake swamps usually consist of very flat land, with sandy soils, adjacent to the old lake borders, grading into heavy clay soils in the interior portions of the old lake beds.

11. *Suitability of peat soils for agricultural use.*—Not all peat soils are readily adaptable to agricultural use. The adaptability de-

pends largely on the depth of the peat soil, the character of the underlying subsoil, and the stage of decomposition of the organic matter of which it is composed. Peat soils are not usually well balanced in plant foods and need artificial fertilization. As a rule these soils are well supplied with nitrogen, but are often deficient in phosphorus and almost universally deficient in potassium. In some cases, owing to the incompleteness of decomposition, there is insufficient available nitrogen for plant growth; and the peat must be treated to hasten decomposition before valuable crop growth can be secured. If the peat soil is shallow and rests on a subsoil containing abundant available supplies of phosphorus and potassium, there is no difficulty experienced in growing crops. However, if the peat is very deep, so that the lack in plant-food elements can not be supplied from the underlying subsoils, it becomes necessary to furnish these plant foods through artificial fertilization. Peat soils are often deficient in the necessary quantities of lime for plant growth. Due to these various facts, careful consideration has to be given to each individual peat swamp to determine its particular needs to fit it for agricultural uses, and this adaptability must be determined before a successful drainage enterprise can be foretold.

12. *Methods of reclamation of swamp lands.*—The reclamation of swamp lands of the glacial type consists in providing general outlets for drainage waters either by straightening or enlarging crooked and inadequate existing water channels, or by constructing new channels of sufficient capacity to dispose of flood waters and of sufficient depth to give underground drainage for the lowest-lying lands of the swamp area. Supplementing these general outlets, lateral extensions into the swamp at intervals are necessary for general drainage. In some cases the main outlet and lateral system will be sufficient to provide fairly complete reclamation of the lands. Usually, however, for complete drainage there must be added to this construction tile systems varying in extent with the character of the land to be drained. In the scheme of reclamation of swamp lands for soldier settlements it is assumed that these tile systems must be extended to each individual farm and made to include all or part of the farm, as circumstances may dictate.

13. *Feasibility of reclaiming swamp lands.*—It is evident that not all swamp lands are feasible of reclamation. Some of these lands lie at such low elevations that no gravity outlets can be constructed at reasonable cost, and pumping drainage water in generally uneconomical. Still other tracts are so distantly located from markets or require such amounts of artificial fertilizer as to exclude them from profitable use for agriculture. However, a large proportion of the swamp lands of the glacial region is susceptible of economical reclamation and agricultural use. When properly drained, and in some cases properly fertilized, these lands constitute some of the richest lands of the United States. Instances of this are found in large acreages of land of this character now being profitably farmed in the upper Mississippi Valley, particularly in Indiana, Illinois, and Iowa. Careful consideration of the various merits and demerits of peat soils, however, must be had in each individual case, in order to insure success in the selection, reclamation, and agricultural development of swamp lands.

14. *Area of swamp lands.*—There is a large acreage of undeveloped swamp land scattered throughout the northern division, but this land is largely concentrated in the Great Lakes States. Swamp lands may be divided into those permanently swamp and those periodically swamp. The difference between these two classes lies principally in the perviousness of the underlying soil, in the varying seasonal and annual precipitation, and in the relative efficiency of natural drainage outlets. The total area of swamp lands in the northern division has not been separated from that of overflowed lands, but the combined area of these lands is estimated to be 22,866,000 acres. (See Table 1, p. 115.)

15. *Location of available overflowed lands.*—The overflowed lands consist of the low-lying areas or bottom lands bordering the rivers in the United States that are subject to overflow at times of exceptional floods. Lands of this character abound throughout the northern division along the various streams, but they are principally located on low-gradient, silt-laden streams in the Mississippi River drainage basin.

16. *Cause of overflowed lands.*—Nature generally provides adequately for ordinary events but not so well for extraordinary events; consequently, as might be expected, there is a natural inadequacy of river channels for carrying excessive flood waters. This natural inadequacy of river channels accounts for a considerable proportion of the overflowed bottom lands of the country. Undoubetdly, however, human agencies are responsible for much of the present overflowed lands along our rivers. In many cases city improvements have encroached on the natural channels of the streams, resulting in higher water stages and inundations of adjacent low-lying lands. The draining of swamp lands in the glaciated regions has greatly increased their maximum flow. The cultivation of vast areas within the drainage basins of the rivers has greatly increased the silt loads of these rivers, resulting in the filling of natural channels and the broadening and heightening of river stages. As civilization has advanced, there has been, therefore, a constantly increasing area of these rich bottom lands overflowed during the maximum flood stages of rivers.

17. *Suitability of soils of overflowed lands for agricultural uses.*—Naturally, the overflowed lands along the rivers of our country are of alluvial character and origin. As a result there is a mixture of soil particles from a wide range of sources, including likewise particles of undecayed or decaying vegetable matter. Hence these soils contain, as a rule, a well-mixed and well-balanced proportion of plant foods, and are therefore among the most fertile and productive soils in the world.

18. *Methods of reclamation of overflowed lands.*—The primary problem in the reclamation of overflowed lands consists in the construction of levee systems or of improving river channels to prevent the flood waters of the river from spreading over the adjacent low-lying lands. The second feature of this class of land reclamation consists in the provision of drainage works for disposing of local surface waters either through channels carried to lower levels or by means of pumping plants. Generally, the complete reclamation of overflowed lands requires open ditches and underground tile

systems for keeping down the ground-water plane within the area itself, resulting from local precipitation and seepage, and pumping plants or gravity outlets for these systems.

19. *Feasibility of reclamation of overflowed lands.*—Owing to the exceptional fertility of the soils of overflowed lands the reclamation of these lands may be undertaken at a comparatively high cost. Cost of maintenance is an important feature because of the levee systems and pumping plants often accompanying this class of reclamation. Large acreages of these lands have already been reclaimed in Ohio, Indiana, Illinois, Iowa, and Missouri, and these reclaimed lands form some of the best lands in these fertile agricultural States.

20. *Area of overflowed lands.*—While there is a considerable area of overflowed lands along the rivers in the northern division, yet the total of these areas is small compared with that of the swamp lands already discussed. (See par. 14.)

21. *Location of cut-over lands.*—The unoccupied timber cut-over lands of the northern part of the United States are concentrated into five fairly well segregated areas. There is a large area in the upper Appalachian Mountain system in the New England and Atlantic Central States; another large area is situated in what is called the Great Lake States—that is, Minnesota, Wisconsin, and Michigan; a third area exists in the Ozark region in Missouri and Arkansas; still another area is found in the Rocky Mountain region in western Montana, northern Idaho, and eastern Washington; the fifth area lies in the Cascade and Sierra Nevada Mountain regions along the Pacific coast. In the mountain regions the cut-over lands best suited to agriculture are generally situated in the river valleys where the soils are mostly of a rich alluvial character. Those in the Great Lakes States are scattered throughout the great glacial plains of that region and have rich glacial soils interspersed with soils not all well adapted to agriculture. The agricultural lands of the Ozark group are found in the river valleys and on flat upland areas of the Ozark uplift. Many of these areas of cut-over lands, particularly in the Great Lakes, Appalachian, and Ozark groups, are situated close to large centers of population and, as a class, offer an excellent field for agricultural prosperity.

22. *Classification of cut-over lands.*—The primary need of all the cut-over area is that of classification of the lands into those suitable for agriculture, grazing, and silviculture. A little of this classification work already has been done by the United States Forest Service in the northwest and some more has been roughly done in these investigations. Until such classification is completed there can be no general rational treatment of the cut-over lands as a whole. When it is made, lands suited only for reforestation can be allowed to revert to forests or can be reseeded; those suited to grazing can be utilized for that purpose; those adapted to agriculture can be put under cultivation.

23. *Suitability of cut-over lands for agricultural uses.*—The soils of timber lands are not generally so rich in nitrogen as those of prairie lands; first, because timber, on account of its deeper root penetration and slower growth, will grow on poorer soil than will grass; and, second, because it does not fertilize the soil with nitrogen

through annual decay so liberally as does grass. Consequently, timber soils originally having the same mechanical and chemical composition as those of prairie soils are often somewhat deficient in nitrogen. Thus it appears that timber soils are usually weak in the plant-food element in which peat soils are strong. Both soils, therefore, generally need fertilization. Nitrogen for the timber soils can be produced by introducing clover into the crop rotation; the deficient potassium of the peat soils must be bought. Both soils may also need lime. Much of the undeveloped cut-over areas of the Great Lakes States has the same rich agricultural value as have those already developed in the long-used cut-over areas of northern Ohio, Indiana, and Illinois. Unquestionably future generations will see much the same general agricultural development in a large proportion of the cut-over areas of the Great Lakes States as now exists in the more matured cut-over areas of the older States already referred to. The cut-over areas of the northern division are in regions of sufficient rainfall for crop production without irrigation. Part of those in the western division has a heavy rainfall in the early season and only limited irrigation is beneficial in some cases during the latter part of the summer.

24. *Methods of clearing cut-over lands.*—There are four well-known methods of land clearing in vogue in the cut-over regions of the United States. These different methods will be designated as the pasturing, burning, blasting, and pulling methods. In the application of any of these methods it is generally desirable to slash the land first so as to permit its seeding to clover and grass in the case of pasturage or to permit ready operation of machinery in case of applying other methods. In the pasturing method the slashed lands are seeded to clover and grass, and the lands are utilized for pasturage purposes until such time as the stumps and roots become sufficiently rotted to permit of cultivation of the land without actual removal of the stumps. Where the stumps are mainly of rapidly decaying species, clearing by pasturing is worthy of consideration. In any event, the utilization of the pasturing method for sufficient time to allow partial decay of the smaller roots of the stumps is desirable, so far as practicable, before removing the stumps by other methods of clearing. The burning method is comparatively inexpensive in outlay for supplies and equipment, but it is not effective in loose or sandy soils and is a very slow and tedious process for a small operating force. The blasting method is rapid and effective; requires a small operating force and a moderate equipment, but it requires a heavy outlay for explosives. The pulling method requires comparatively expensive equipment, a small operating crew, and does very good work, but is not readily applicable to large stumps. Various combinations of these different methods may often be applied to advantage, particularly pasturing, blasting, and pulling.

25. *Feasibility of reclamation of cut-over lands.*—The cost of clearing cut-over lands varies with (*a*) the character of the soil, (*b*) the nature of the forest growth, and (*c*) the methods used in clearing. Where explosives are used the tightness of the soil adds to the effectiveness of the explosives. The best results are, therefore, obtained in clay soil and the poorest in sand, with intermediate results for loam soil. The nature of the second growth, the size, the num-

ber per acre, the stage of decay of the stumps, and the species of parent trees of the stumps all are controlling factors in cost of land clearing. The effect of the different species of trees is highly important because of their sectional distribution in the cut-over regions of the country.

The Great Lakes States are the home of the white pine intermingled with hardwoods. The Ozark region is essentially the home of the hardwoods; the Southern States of yellow pine; and the Pacific Northwest of the larch and fir. White pines and hardwoods, as a rule, have no tap roots, but have large spreading roots fairly easily removed. Large yellow pines have large strong tap roots and are difficult and expensive to remove. Larches have roots entering the ground obliquely and are therefore difficult of removal. Fir roots are similar in habit to white-pine roots, but the immense size of fir stumps makes them difficult and expensive to remove. As a result land clearing is generally considered cheaper in the Great Lakes States and the Ozark regions than in the other two regions, and it is cheaper in the South than in the Pacific region, where land clearing often is a very expensive operation. Taken as a whole, the clearing of cut-over lands on good agricultural soils for agricultural use is eminently feasible and offers splendid opportunities for extending the agricultural resources of the United States.

26. *Degree of reclamation of cut-over lands.*—The degree to which the reclamation of lands is to be carried is an important factor in the problem of land development by the Government either for agricultural homes for soldiers or for general agricultural purposes. Whether complete preparation of the land for occupancy and cultivation or whether some intermediate course should be adopted is worthy of profound consideration. In the reclaiming of cut-over lands it appears that at least some form of clearing of the farm will undoubtedly be desirable. The preliminary preparation of 15 to 30 per cent of such lands for cultivation by clearing would enable the settler to obtain an immediate means of support, in part at least, until more land could be reclaimed by him. Whether a complete clearing of the land of the farm is to be done is worthy of careful consideration, because such clearing may be done by the settler himself at odd times without much financial outlay. In such case a clearing program should be laid down to be followed by the settler to assure the reclamation of the land. In most cases it will be desirable to require the preservation of a small wood lot for the settler's use for fuel and fence posts.

27. *Area of cut-over lands.*—The total area of cut-over lands in the northern division is indeed very large, but the investigations made up to the present time indicate that only a part of these lands can ever be profitably used for agriculture. The nearest estimate that can be given at the present time of the total area in the northern division, including 3,645,000 acres in California, Idaho, Montana, Oregon, and Washington, suitable for agriculture is 22,483,000 acres. Information concerning acreage and character of the cut-over lands for the northern division, tabulated by States, will be found in Table 2, page 115.

28. *Offers of land for soldier settlements.*—In the northern division no requests were made, either on landowners or State officials, for offers of lands for soldier settlements, but numerous offers at

reasonable prices were voluntarily made by a great number of parties in different States in the division. Had it been considered desirable to make requests for offers of lands undoubtedly a great many more would have been received, as the possibility of such offers is large in many of the States of the northern division. The voluntary offers received, amounting to about 3,800,000 areas, have been summarized by States in Table 3, page 116, of this report.

TABLE 1.—*Estimated total, investigated and available acreages of swamp and overflows in northern division.*

States.	Estimated present acreage.	Acreage investigated.	Estimated acreage investigated available for settlement.
Connecticut	59,000	.....	.....
Illinois	762,000	513,000	.....
Indiana	660,000	82,000	.....
Iowa	542,000	70,000	.....
Kansas	463,000	281,000	20,000
Maine	187,000	.....	.....
Massachusetts	133,000	12,000	12,000
Michigan	5,434,000	456,000	220,000
Minnesota	6,828,000	735,000	250,000
Missouri	1,000,000	910,000	330,000
Nebraska	300,000	80,000	.....
New Hampshire	19,000	.....	.....
New Jersey	377,000	30,000	30,000
New York	700,000	114,000	64,000
North Dakota	750,000	20,000	20,000
Ohio	257,000	30,000	.....
Pennsylvania	57,000	.....	.....
Rhode Island	12,000	.....	.....
South Dakota	500,000	387,000	10,000
Vermont	23,000	.....	.....
Wisconsin	3,803,000	539,000	220,000
Total	22,856,000	4,259,000	1,176,000

TABLE 2.—*Estimated total unoccupied acreage, acreage thereof suitable for agriculture and investigated acreage available for community settlement of cut-over lands in States covered by northern division.*

States.	Total estimated acreage.	Estimated acreage suitable for agriculture.[1]	Estimated minimum acreage investigated available for community settlement.
California	1,300,000	355,000	155,000
Connecticut	1,000,000	300,000	.....
Idaho	1,000,000	476,000	127,000
Maine	6,000,000	(2)	30,000
Massachusetts	2,000,000	(2)	30,000
Michigan	8,700,000	4,200,000	2,000,000
Minnesota	8,800,000	5,300,000	2,500,000
Missouri	13,000,000	3,000,000	1,500,000
Montana	695,000	312,000	95,000
New Hampshire	2,600,000	(2)	10,000
New Jersey	1,150,000	600,000	300,000
New York	6,000,000	.....	.....
Oregon	2,700,000	830,000	385,000
Pennsylvania	5,300,000	(3)	10,000
Rhode Island	360,000	185,000	15,000
Vermont	2,000,000	(2)	10,000
Washington	4,500,000	2,025,000	570,000
Wisconsin	7,500,000	4,900,000	2,500,000
Total	74,605,000	22,483,000	10,237,000

[1] This does not include lands suitable for grazing. [2] Unknown. [3] Small.

TABLE 3.—*Summary by States—Offers of land of 1,000 acres or over for soldier settlement in northern division.*

State.	Amount of land offered.	Remarks.
	Acres.	
California	16,000	
Idaho	.....	Included with Washington.
Maine	38,000	One project.
Massachusetts	93,600	
Michigan	649,300	Also "several thousands" of acres.
Minnesota	567,000	Also land in Red Lake Reservation.
Missouri	1,145,500	Also "large tracts."
Montana	7,700	
New York	44,200	
North Dakota	20,000	
Ohio	1,000	
Oregon	3,000	
Pennsylvania	14,500	
Washington	391,000	Includes some in Idaho.
Wisconsin	838,500	Also large areas in "Glacial Lake" area and in Langlade County.
Total	3,829,300	

CALIFORNIA.

GENERAL STATEMENT.

29. *Scope and results of investigations.*—The work in California, done under the supervision of the northern division, consisted in compiling existing information on the cut-over lands of the State. The investigations of the arid lands and the lands needing drainage in the State were made under the supervision of the western division. The results of the investigations on cut-over lands indicate that there are 12 areas of these lands in California which contain considerable good agricultural lands as well as large acreages of grazing lands. The cut-over lands of the State naturally fall into the redwood group and the pine group. These two classes of cut-over lands will be treated separately in detail in the following paragraphs. For a classification of the cut-over lands of the State by counties, see Table 5, page 119.

30. *Offers and prices of lands.*—No offers of land for soldier settlements were solicited in California, but there are large acreages available in large holdings, and no difficulty is anticipated in securing lands in bodies suitable for use. The cut-over lands of the State are, as a rule, assessed at a little over one-third of their actual value, and the assessed value ranges from about $1.50 to $10 per acre. The actual value of the land, therefore, on this basis, would be about $5 to $30 per acre. Improved lands in the redwood districts are valued at from $50 to $600 per acre, and those in the pine districts at from $25 to $300 per acre.

31. *Soils and agricultural possibilities.*—The soils of the redwood lands are mainly of volcanic origin and are usually rich in all plant foods except nitrogen, and productive. The soils of the pine regions are partly derived from volcanic rocks and partly from granitic formations. In most of the pine areas the soils have proved agriculturally successful. On the whole, the cut-over areas of California classed as agricultural lands may be said to have good agricultural possibilities.

REDWOOD CUT-OVER LANDS.

32. *Location.*—The redwood cut-over lands of California lie on the extreme western slope of the Cascade Mountains along the Pacific coast in Del Norte, Humboldt, Mendocino, San Mateo, and Santa Cruz Counties. The lands suitable for agriculture are situated on the table-lands, on the ridge tops, and along the streams at from 10 to 40 miles back from the coast. On the slopes between the summits of the ridges and the streams there are large areas of land suitable for grazing, and these lands can, in a large measure, be utilized with the farm lands. The area suitable for agricultural development is estimated to be about 132,000. (See Table 4, p. 118.)

33. *Agricultural possibilities.*—The redwood cut-over lands lie in the fog belt of the Pacific coast and they have a very uniform climate. The temperature ranges from about 30° to 80° above zero and the annual precipitation averages about 36 inches. Irrigation is not necessary to crop growth. Numerous farms have been established on the cut-over lands of the redwood area and are proving to be very useful and productive. The lands are adapted to the production of oats, alfalfa, vegetables, berries, and, in the more rolling parts of the country, in addition thereto, apples, cherries, peaches, plums, pears, and grapes.

34. *Engineering plan and feasibility.*—The redwood cut-over lands, since they have been logged off, have become thickly overgrown with brush of various kinds, and there have sprung up from the redwood stumps many suckers, some of which are growing rapidly into trees. Considerable growths of Douglas and white fir have begun to establish themselves in some places. The redwood stumps are very large and decay slowly, but they are not thick on the ground, and it is possible to do considerable farming without removing them. The primary reclamation work will consist, therefore, in removing small trees of commercial value, in brushing the land and in putting it in pasture, or in removing the small stumps and putting it into inter-stump crops. Ultimately the main stumping can then be done either by the farmer as time permits or partly by him and partly by the Government as good business may dictate. The cut-over lands of this class are all in private ownership and many of the areas are held in comparatively large tracts.

35. *Transportation facilities and towns.*—Transportation facilities for the redwood cut-over lands are furnished through a branch of the Southern Pacific Railroad, passing near the eastern limits of the lands, with interjecting branches, and by shipping facilities through harbors along the Pacific coast. There are small towns located within or near the agricultural lands of the redwood cut-over regions, but the principal markets for these lands exist at the large cities on the Pacific coast.

PINE CUT-OVER LANDS.

36. *Location and acreage.*—The pine cut-over lands of California are found along the streams and on the plateaus and rolling hills in the cut-over areas on the western slope of the Sierra Nevada Mountains, and are divided into seven groups, designated in this report as the Siskiyou, McClouds River, Lassen, Feather River, American

River, Tuolumne, and San Joaquin River projects or areas. It is roughly estimated that there are approximately 192,000 acres of these lands suitable for development for agriculture. (See Table 4, below.)

37. *Agricultural possibilities.*—The mean annual precipitation of this region varies from 30 to 45 inches, but in some places is as low as 15 inches. The snowfall is fairly heavy in the higher altitudes. Although the rainfall in the larger part of the areas of pine cut-over lands is sufficient for growing most crops, there are many localities in which irrigation can be used to advantage. The principal agricultural products are cereals, alfalfa, potatoes, vegetables, fruits, and nuts. Stock raising also is an important industry, and it has already progressed to a highly developed stage.

38. *Engineering plan and feasibility.*—These cut-over lands are largely overgrown with small brush, and there is considerable "down" timber in many localities. There is also some small timber scattered throughout the area which must be removed in connection with the general operations of brushing and disposing of the "down" timber. Reclamation, therefore, will consist of brushing the land, including the disposal of the "down" timber, stumping a portion of it for cultivation purposes, and brushing other portions of it and sowing it to grass crops in order that it may be utilized while the stumps are maturing for removal and while the farmer is, himself, removing these stumps as time will permit.

39. *Transportation facilities and towns.*—The pine cut-over lands of California are served by the Southern Pacific Railroad, which passes along the edge of the district, and by various branches thereof extending up into the areas. Logging railroads, logging wagon roads, and other highways are numerous throughout the cut-over areas and these can be utilized with success in opening the lands for reclamation and settlement. Numerous small towns exist throughout each of the pine cut-over areas, which will furnish local markets for many of the agricultural products. The outlet for the bulk of products, however, will be through the large cities on the Pacific coast.

TABLE 4.—*Agricultural cut-over land in California.*

Projects.	County.	Acreage suitable for agriculture.	Estimated acreage available for community settlement.
Redwood group:			
Del Norte	Del Norte	5,000	.....
Eel River	Humboldt	40,000	20,000
Mendocino	Mendocino	52,000	25,000
Santa Cruz	Santa Cruz, San Mateo	25,000	15,000
Sonoma	Sonoma	10,000	10,000
Pine group:			
American River	Sierra, Nevada, Placer, Eldorado	90,000	30,000
Feather River	Plumas, Tehama, Butte	15,000	10,000
Lassen	Lassen, Shasta	13,000	10,000
McClouds River	Shasta, Siskiyou	10,000	10,000
San Joaquin	Fresno, Tulare	5,000	.....
Siskiyou	Siskiyou	45,000	15,000
Tuolumne	Amador, Calaveras, Tuolumne	14,000	10,000
Total	.....	324,000	155,000
Other areas, various	.....	31,000	.....
Estimated total in State	.....	355,000	.....

TABLE 5.—*Classified unoccupied cut-over lands in various counties in cut-over regions of California.*

County.	Area of unoccupied cut-over lands.	Area most suitable for reforestation.	Area most suitable for agriculture.	Area most suitable for grazing.	Prevailing price of cut-over lands.
Amador	14,700	7,600	2,900	4,200	$10–15
Butte	38,500	19,200	5,800	13,500	3–10
Calaveras	10,700	5,500	2,100	3,100	3– 5
Del Norte	9,600	1,900	4,800	2,900	15–30
Eldorado	25,100	10,000	6,300	8,800	5–10
Fresno	33,800	16,800	6,800	10,200	5–10
Humboldt	96,300	26,500	39,700	30,100	10–25
Kern	8,900	4,400	1,800	2,700	.....
Lake	8,200	3,400	1,600	3,200	.....
Lassen	6,000	3,000	1,500	1,500	5–15
Madera	7,400	3,700	1,500	2,200	3– 5
Mariposa	8,900	4,400	1,800	2,700	10–15
Mendocino	174,700	69,900	52,400	52,400	5–10
Nevada	202,800	81,100	50,700	71,000	3– 5
Placer	117,000	47,000	29,000	41,000	5–10
Plumas	19,200	10,600	4,800	4,800	5–10
San Mateo	26,000	9,400	7,800	7,800	20–50
Santa Cruz	60,700	24,300	18,200	18,200	5–25
Shasta	48,600	25,800	16,200	6,600	2–10
Sierra	21,800	10,900	4,400	6,500	2–10
Siskiyou	177,600	70,700	44,400	62,500	2–10
Sonoma	36,600	7,300	18,300	11,000	3–10
Tehama	120,000	60,000	24,000	36,000	3–10
Tuolumne	35,200	17,700	7,000	10,500	5–10
Yuba	9,700	5,900	1,500	2,300	5–10
Total	1,318,000	547,000	355,300	415,700	.....

CONNECTICUT.

GENERAL STATEMENT.

40. *Opportunities for projects in Connecticut.*—Endeavors made through cooperation with State officials and personal inspection to locate areas in Connecticut suitable for soldier settlements have not yet been satisfactorily successful in this State. There are about 300,000 acres of cut-over lands in the State reported to be suitable for agriculture and about 59,000 acres of swamp lands. There are also a considerable number of neglected farms available, but these are somewhat scattered. It seems probable, therefore, that further investigation may disclose sufficient farms of the above description fairly closely situated that may be combined with the purchase of small adjacent farms to make a compact area for a project in this State, or that a combination of such farms with some of the unoccupied cut-over lands reported to be suitable for agriculture may be effected.

IDAHO.

GENERAL STATEMENT.

41. *Scope and results of investigations.*—Investigations of the cut-over lands of Idaho have resulted in locating eight tracts of considerable size, all of which contain promising agricultural possibilities. Owing to lack of space, it will be impossible to give separately here for each of these tracts detailed information as to soils, topography, climate, and agriculture, although such information has

been obtained for each of them. These eight tracts may logically be subdivided into two groups of four areas each. The northern area consists of what may be designated the glacial group, and the southern area of what may be termed the volcanic group. Separate discussions will be devoted to each of these groups in the following paragraphs. These investigations did not include swamp and overflowed lands in this State. (See Table 7, p. 124, for a general classification of cut-over lands in Idaho.)

42. *Offers and prices of land.*—No offers of land for soldier settlements were solicited in Idaho and none received, except for some small areas overlapping from larger holdings in eastern Washington. There are numerous tracts held in large ownerships, and no difficulty will be encountered in securing lands in compact enough bodies for soldier settlements in most of the eight areas investigated. Raw cut-over lands of good quality in these regions can be secured at from $5 to $25 per acre and improved lands vary in price from $50 to $100 or more per acre.

43. *Soils and general agricultural possibilities.*—The soils of the glacial group of cut-over lands range from silt loam to fine sandy loam in the northern part of the territory, to stony loams as the morainic limits of glaciation are approached. In the volcanic group the soils range from clay loam to sandy loam and are generally free from stones. Practically all of this group lies in the Columbia River lava flow area, and the surface soils consist of residual soils formed from disintegration of the underlying lava rock. Exceptions to this rule exist in the alluvial soils of the river bottoms and in a small portion of the Coeur d'Alene tract north of Coeur d'Alene Lake, where the soil is residually formed from granitic rock. Generally speaking, the soils of both regions are well supplied with all of the plant foods except nitrogen and produce well under proper methods of farming. Taken as a whole, the lands are well adapted to diversified farming, fruit growing, and stock raising.

GLACIAL CUT-OVER LANDS.

44. *Location.*—The glacial cut-over lands of northern Idaho are grouped into four areas designated as the Bonners Ferry, Sandpoint, Priest River, and Spirit Lake tracts. The Bonners Ferry tract is situated in Boundary County along the Kootenai River in the northeastern corner of Idaho, with a narrow strip extending up the Moyie River, a tributary of Kootenai River. The Sandpoint tract lies in Bonner County to the north and west of Lake Pend O'Reille and comprises the lower valleys of the Pack River and Sandpoint Creek and a portion of the valley of Clarks Fork. The Priest River area lies in Bonner County and occupies the valley of Clarks Fork in the vicinity of the mouth of Priest River, the Priest River Valley, the broad outwash plains south of Priest Lake, and lowland areas west of Priest Lake extending to the Washington State line. The Spirit Lake tract lies in Bonner and Kootenai counties in the depression between Mount Carlton on the west and the Cœur d'Alene Mountains on the east and between Cocolala Lake on the north and Hayden Lake on the south. In all of these tracts the agricultural lands comprise

alluvial lowlands and terraces along the streams, with adjacent glaciated hills.

45. *Acreage.*—In Table 6, page 124, are tabulated data relating to the glacial cut-over lands. It will be noted that the total estimated area of these tracts suitable for agriculture is 208,000 acres, of which 80,000 acres are supposed to be available for community settlements.

46. *Agricultural possibilities.*—The annual precipitation in this part of Idaho varies from about 20 to 28 inches. Most of this occurs between September 1 and June 1 of the following year, resulting in a dry period during the summer months. This condition necessitates largely the growing of crops that mature in the early part of the season, or in the practice of irrigation. Consequently, while fairly good results may be obtained without irrigation, the best results in practically all of the areas are obtained by irrigation. Without irrigation hay, small grains, early fruits, and early vegetables can be grown successfully. With irrigation additional hay crops, and later and better fruits and full-season vegetables can be grown with success. Taken altogether, the agricultural possibilities of the region are considered to be satisfactory. However, each locality should be considered on its merits.

47. *Engineering plan and feasibility.*—The stumps in this region consist of those of white pine, cedar, red fir, and larch trees ranging from medium to large-size growths. In the logging operations there was left a considerable quantity of small timber; and, where the land has been cleared for some time, there are growths of brush and young trees of the parent species. However, the brush and young growths in these regions are not so luxuriant as they are in the more humid regions of the United States. The process of reclamation of this group of cut-over lands will consist, therefore, in the removal of small standing timber, fallen timber, brush, and young growth. After this slashing operation, the stumps must be removed for small areas on each farm to permit of immediate crops. Most of the stumps encountered in this region are easily removed with the exception of those of the large yellow pine and larch trees.

48. *Ownership of lands.*—The cut-over lands of the Bonners Ferry and Priest River tracts are mainly owned by small holders; those of the Sandpoint tract by private holders in small tracts and by railroads in large tracts. On the Spirit Lake tract a portion of the land has been disposed of by the lumber companies to small holders but the lumber companies still own considerable acreage. It is believed that no difficulty, however, will be encountered in securing areas within each of these tracts of sufficient size for one or more soldier settlements.

49. *Transportation facilities.*—Inasmuch as the glacial cut-over lands consist of the river valley lands of northern Idaho and of lands closely adjacent thereto and inasmuch as the principal highways and railways of the region follow the rivers, these tracts are generally well supplied with transportation facilities. These principal highways and railroad lines are supplemented with logging railroads and wagon roads, which will be of use in the development and utilization of the cut-over lands. The main line of the Great

Northern Railroad runs through the Bonners Ferry and Sandpoint tracts, and touches the southern portion of the Priest River tract. The main line of the Northern Pacific Railroad runs through the Sandpoint and Spirit Lake tracts. The Spokane International Railroad runs through Bonners Ferry, Sandpoint, and Spirit Lake tracts. These lands are, therefore, all well equipped with railroad facilities with the exception of the Priest River tract.

50. *Towns and markets.*—There are small towns connected with the existing agricultural, mining, and timber industries of northern Idaho scattered throughout the four cut-over areas. These small towns, with their accompanying industries, furnish very good local markets for a large proportion of the agricultural products of the region. The city of Spokane is within a short distance of this area and Seattle and Portland are connected by through railroad service with it.

VOLCANIC CUT-OVER LANDS.

51. *Location.*—The Coeur d'Alene tract includes the country surrounding Coeur d'Alene Lake and a strip of bottom land extending eastward along the Coeur d'Alene River. It also extends to the westward of Coeur d'Alene Lake to the State line and southward from the lake to the St. Joe River. The whole area lies in Kootenai County and drains into Coeur d'Alene Lake, thence into the Columbia River through Snake River. The St. Maries tract lies in Benewah County south of St. Joe River and west of the St. Maries River and drains chiefly into these rivers, although a portion of it lies in the drainage basin of Hangman Creek, a tributary of the Palouse River. The Potlatch area is situated in Latah County and lies to the south of the Palouse Mountains on the headwaters of the Palouse River and in the drainage basin of Potlatch Creek, a tributary of Clearwater River. The Craig Mountain tract lies in Nez Perce and Lewis counties on the highland area between Clearwater River on the north, Salmon River on the south, and Snake River on the west. All of these lands occupy valleys and rolling volcanic plateaus.

52. *Acreage.*—Table 6, page 124, indicates the total estimated acreage of the volcanic group of cut-over lands suitable for agriculture to be 99,000 acres, of which 47,000 acres are considered available for community settlements. There are 20,000 acres in the valley of the Coeur d'Alene River and 10,000 acres in the valley of the St. Joe River that need drainage. This land may be drained by lowering the dam on the Spokane River at Post Falls, Idaho.

53. *Agricultural possibilities.*—The annual precipitation in the Cœur d'Alene country ranges from 20 to 23 inches. The winters are mild and the summers warm and dry. Owing to the greater altitude of the St. Maries tract, the average annual precipitation varies from 23 to 25 inches, and on the upland regions the snowfall usually amounts to 3 or 4 feet. The winters are comparatively mild; the summers are hot and dry. The climate of the western part of the Potlatch area is similar to that of the Cœur d'Alene tract, and that of the eastern part of the St. Maries tract. The climate of the Craig Mountain tract is similar to that of the eastern Potlatch and to that of the St. Maries tract. In the lower altitudes of the Cœur d'Alene

and Potlatch regions forage, grains, fruits, and vegetables are grown with success. In the higher altitudes the heavy winter snows make dairying and the growing of forage the most promising industries. The dryness of the summers makes irrigation a valuable adjunct to the farming industry, although it is not essential to success.

54. *Reclamation.*—The predominating species of trees in the volcanic region of the cut-over lands are white and yellow pine, Douglas fir, and larch. As a rule the timber does not grow thickly on the ground in this region and the trees are not nearly so large on an average as those on the Pacific coast. In most of the forested areas there are also numerous small, open spaces of prairie. The process of economical clearing will, therefore, consist in disposing of the fallen timber and small growth, and then seeding the land to pasture to await the decaying of the smaller stumps and the smaller roots of the larger stumps. Very often sufficient open land will be found on each 80 or 160 acre tract to supply the need for completely cleared lands for gardens and immediate forage crops. Where such openings do not exist, small clearings will necessarily have to be made in order to meet the early needs of the settler. Later the matured stumps in the pasture may be removed either by the farmer individually or cooperatively with his neighbors or through Government enterprise.

55. *Ownership.*—The bulk of the cut-over lands in the Cœur d'Alene, St. Maries, and Craig Mountain tracts is still held by the operating lumber companies. On the Potlatch tract about one-third of the cleared area is held each by the lumber company, by the State, and by small owners.

56. *Transportation facilities.*—The transcontinental line of the Chicago, Milwaukee & St. Paul Railroad and a branch of the Oregon-Washington Railroad & Navigation Co. passes through the southern portion of the Cœur d'Alene area, and branches of the Northern Pacific and Spokane International railroads extend into Cœur d'Alene at the northern end of the tract. There is no railroad extending directly into the St. Maries tract, but the main line of the Chicago, Milwaukee & St. Paul Railroad passes along its northern boundary and a branch of this road passes up the St. Maries River on its eastern edge; a branch of the Oregon-Washington Railroad & Navigation Co. passes along the western boundary. The Potlatch area is served by a branch of the Northern Pacific Railroad, and also by the main line of the Washington, Idaho & Montana Railroad. A branch of the Northern Pacific Railroad extending up the Clearwater River passes near the northern edge of the Craig Mountain tract, and the Camas Prairie Railroad passes along its northern and eastern boundary.

57. *Towns and markets.*—Numerous small towns exist within these cut-over tracts and in adjacent surrounding territory. These towns will furnish local markets for a large proportion of the agricultural products produced on the cut-over areas. There are good railroad facilities for shipping agricultural products to Spokane, Portland, and Seattle.

TABLE 6.—*Agricultural cut-over lands in northern Idaho.*

Projects.	County.	Acreage suitable for agriculture.	Estimated acreage available for community settlement.
Glacial group:			
Bonners Ferry	Boundary	41,000	20,000
Priest River	Bonner	8,000	8,000
Sandpoint	Bonner	36,000	20,000
Spirit Lake	Bonner-Kootenai	123,000	32,000
Volcanic group:			
Coeur d'Alene	Kootenai	26,000	10,000
Craig Mountain	Benewah	26,000	10,000
Potlatch	Latah	40,000	20,000
St. Maries	Nez Perce, Lewis, Clearwater	7,000	7,000
Total		307,000	127,000
Other areas, various		169,000	.....
Estimated total in State		476,000	.....

TABLE 7.—*Unoccupied cut-over lands in various counties in cut-over regions of northern Idaho.*

County.	Area most suitable for agriculture.	County.	Area most suitable for agriculture.
	Acres.		*Acres.*
Benewah	26,000	Latah	90,000
Bonner	195,000	Lewis	20,000
Boundary	45,000	Nez Perce	5,000
Clearwater	5,000		
Kootenai	90,000	Total	476,000

ILLINOIS.

GENERAL STATEMENT.

58. *Opportunities for projects in Illinois.*—Illinois originally contained large acreages of timber lands and large acreages of swamp lands, but these have been very largely reclaimed and put to use. In the river valleys of the State there are considerable areas of land that are yet subject to overflow during high-water stages, although material progress has also been made in the reclamation of these lands. Most these overflow lands are occupied and farmed at the present time. In table 8, page 37, are listed the larger areas of unreclaimed overflow and swamp lands of the State. It will be noted that it is estimated that there are 762,000 acres of land in the State needing drainage. Further investigations may disclose areas suitable for soldier-settlements in some of these unreclaimed areas.

It is probable that the most available lands for colonies are lands held in large tracts and now farmed by tenants.

TABLE 8.—*Lands now needing drainage in Illinois.*

Projects.	County.	Acreage.
Embarrass River	Several	84.000
Illinois River	do	125,000
Kaskaskia River	do	160,000
Little Wabash River	do	53,000
Skillet Fork River	do	75,000
Spoon River	Fulton	16,000
Other areas	Various	249,000
Estimated total in State		762,000

INDIANA.

GENERAL STATEMENT.

59. *Opportunities for projects.*—The large timbered areas of Indiana have been mainly cleared and put under cultivation and most of the large acreages of swamp lands have been reclaimed. Investigations were, however, made for the purpose of locating undeveloped wet lands in the Kankakee River Valley, in the Patoka River Valley, and in the slash-land area of southeastern Indiana as being the most likely places to find unreclaimed areas suitable for settlements. The field investigations resulted in securing information relating to two tracts, one with an area of 51,000 acres in the Wabash River bottom at the mouth of the Patoka River, and another of 31,000 acres in the Patoka River Valley above the Wabash bottom. While these lands are excellent for agricultural purposes, they are largely occupied and under cultivation, but several areas are vacant and compact enough for settlement. Several locations are known where considerable tracts are held in one or two ownerships and farmed by tenants, which could be made available for colonies.

TABLE 9.—*Lands now needing drainage in Indiana.*

Projects.	County.	Acreage.
Patoka River	Gibson, Pike, and Dubois	31,000
Wabash River	Gibson	51,000
Small tracts	All	578,000
Estimated total in State		660,000

IOWA.

GENERAL STATEMENT.

60. *Opportunities for projects.*—Although there is a considerable acreage of land needing drainage in Iowa, it lies in small bodies in the flat lands of the north-central part of the State and along the rivers and creeks. One of the largest areas in the State now needing drainage lies in the lower valley of the Little Sioux River. (See Table 10, below.) Present prices and occupancy of the lands will, however, make it difficult to use this area for a Government project. It is unnecessary to state that there are no cut-over lands available in Iowa. There are opportunities for securing large holdings of land in the State, particularly in the north-central part, that may be subdivided and used for soldier settlements.

TABLE 10.—*Lands needing drainage in Iowa.*

Projects.	County.	Acreage.
Little Sioux River	Monona and Harrison	70,000
Small tracts	All	340,000
Estimated total in State		410,000

KANSAS.

GENERAL STATEMENT.

61. *Scope and results of investigations.*—Kansas is essentially a prairie State and contains no areas of cut-over lands of consequence. The investigations were, therefore, confined to locating lands needing drainage in tracts of sufficient size for soldier settlements, lying east of the 98th meridian. No lands of this character were found other than those in the Marais des Cygnes, Cottonwood, Verdigris, and Neosho River Valleys, which have been investigated and reported upon by the United States Department of Agriculture. It is thought that possibly one or both of the last two named of these areas may on further investigation be found to be suitable for soldier settlements. Brief detailed descriptions of them, therefore, will be here given.

62. *Offers and prices of lands.*—No solicitations for lands were made in Kansas and no offers were volunteered. The prices of lands needing protection from floods in the valleys named in the preceding paragraph vary from $20 to $100 per acre, and improved lands not subject to overflow from $50 to $200 or more per acre.

63. *Soils and general agricultural possibilities.*—All four of the tracts mentioned lie in overflow areas of river valleys and the soils are derived residually, partly from the underlying strata of limestone and partly from transported materials from similar soils on the uplands of the drainage basins of the rivers. The climate and rainfall of southeastern Kansas are such as to make the agricultural possibilities excellent on good soils. The lands are adapted to diversified farming.

LANDS NEEDING DRAINAGE.

NEOSHO RIVER PROJECT.

64. *Location and acreage.*—The Neosho River project comprises the bottom lands along the Neosho River subject to overflow at high-water stages. The lands are situated in Lyon, Coffey, Woodson, Allen, Neosho, and Labette Counties in southeastern Missouri and amount in all to about 160,000 acres.

65. *Soils and agricultural possibilities.*—The soils in the valley of the Neosho River where protection from overflow is needed consist of rich dark loam or silt loam and are fertile. The principal crops are corn, wheat, and hay, and the yields are quite satisfactory when the floods do not interfere.

66. *Engineering plan and feasibility.*—The plan of reclamation is considered entirely feasible and consists of clearing the river channel of obstructions, the straightening of the channel in a few of the worst places, flanking the improved channel on both sides at suitable distances with adequate levees with return branches up the principal tributaries, the complete clearing of the area between the levees, and the providing of drainage behind the levees by means of outlets through the levees. It is thought that the cost will be well within the benefits produced by the improvement.

67. *Transportation facilities and towns.*—The lands of the project are well served with branches of the Atchinson, Topeka & Santa Fe

and the Missouri, Kansas & Texas Railroads, and there are many thriving towns in the valley. The principal towns are Emporia, Iola, Chanute, and Parsons, and the whole region is admirably connected with Kansas City.

VERDIGRIS RIVER PROJECT.

68. *Location and acreage.*—This project contains 48,000 acres of bottom land subject to overflow by the Verdigris River in Wilson and Montgomery Counties in southeastern Kansas.

69. *Soils and agricultural possibilities.*—The soils consist of an alluvial deposit of several feet in depth varying from a dark brown to a rich deep black in color. In some places the soil is of a light mechanical texture and in others of a heavier waxy character. The lands are considered fertile and produce corn, wheat, oats, and alfalfa.

70. *Engineering plan and feasibility.*—The reclamation would be accomplished by channel improvement and levee protection with means for draining the lands back of the levees. Further investigations are necessary here as in the other project referred to in this State.

71. *Transportation facilities and towns.*—Transportation is supplied by branches of the Atchinson, Topeka & Santa Fe and the Missouri Pacific Railroads. The principal towns are Coffeyville and Independence, which are connected with excellent electric-car service.

TABLE 11.—*Lands needing drainage in Kansas.*

Projects.	County.	Acreage.
Cottonwood River	Lyon, Chase, Marion	10,000
Marais des Cygnes River	Linn, Miami, Franklin, Osage	33,000
Neosho River	Cherokee, Coffey, Labette, Neosho, Allen, Woodson.	100,000
Verdigris River	Montgomery, Wilson	48,000
Scattered small tracts	All east of ninety-eighth meridian	21,000
Estimated total in State		302,000

MAINE.

GENERAL STATEMENT.

72. *Scope and results of investigations.*—Although it is known that Maine has some 6,000,000 acres of cut-over lands and that it has also some 187,000 acres or more of swamp lands, time and funds were not available for making sufficient detailed investigations of these lands to ascertain with satisfaction the extent and location of such of them as might be available for Government projects. However, three tracts lying in Washington County, comprising approximately 75,000 acres, were located, a large proportion of which it seems may be made available for soldier settlements. One of these tracts, known as the Cherryfield, or Cherryfield-Deblois tract, containing 38,000 acres, was visited and investigated. This tract will be described in subsequent paragraphs of this report under the heading of the Cherryfield project. The Great Columbia Bog on Pleasant River lies to the

east of the Cherryfield tract and forms part of the 75,000 acres of available land above referred to. No investigation was made of this swamp. It is believed that further investigations will disclose other opportunities for projects in this State.

73. *Offers and prices of land.*—One offer of a large tract of land in the State was received for which a price of $5 per acre was asked. The unused lands of Maine are not held at high prices and investigations show that such lands as are available for projects may be obtained at from $5 to $10 per acre.

74. *Soils and agricultural possibilities.*—The agricultural lands of Maine lie largely in the potato-growing regions of the St. Johns River drainage basin of the northern part of the State, and in a diversified farming section along the Atlantic coast varying from 50 to 100 miles or more in width, the eastern end of which is but meagerly developed. The soils in these regions are of glacial origin and the loam and clay types, where they do not contain too great quantities and gravel and bowlders, are generally fertile and productive of the crops suited to the local climatic conditions.

CUT-OVER LANDS.

CHERRYFIELD PROJECT.

75. *Location and acreage.*—The Cherryfield project is located in the townships of Cherryfield and Deblois on the present bottom lands of the Narragaugus River and on the adjacent terraces or bench lands of this river in Washington County. The tract contains approximately 38,000 acres, of which 1,800 acres are bottom lands, 15,000 acres first bench lands, 17,000 acres second bench lands, and 4,000 acres morainic woodlands.

76. *Soils and agricultural possibilities.*—The soils of the bottom lands consist of areas of fine sand intermingled with low ridges of silt and depressions of clay. Those of the first bench consist partly of silt loam overlying a subsoil of clay and of gravelly loamy sand overlying a shallow subsoil of coarse sand resting on clay. Associated with this soil on the gentler slopes is a considerable area of fine sand often resting on a shallow layer of coarse sand with a clay subsoil. The second bench soil consists of a gravelly sandy loam with an underlying stratum of gravelly sand about 4 feet deep resting on clay. The character of the soil, particularly that of the second bench, indicates possible droughtiness and leachiness. However, experiments conducted by private parties on this land indicate that the soils are fertile and adapted to the growing of such crops as the climatic conditions will permit.

77. *Engineering plan and feasibility.*—It is probable that this tract of land was primarily covered with forests, but it is now overgrown with blueberries, grass, and brush. The reclamation of the lands will, therefore, be inexpensive because very little clearing and very little drainage will be needed. It is thought that it will be necessary to apply fertilizers to secure good crops on most of these lands. The cost of reclamation should be small enough to make the development of this project economically feasible.

78. *Transportation facilities and towns.*—Transportation facilities will have to be furnished through the use of motor trucks or through

the construction of a steam or electric line from Cherryfield to the tract. From Cherryfield transportation is available from the Maine Central Railroad. There are possibilities for power development on the Narragaugus River, which can be utilized for the electrification of a car line from Cherryfield into the tract.

TABLE 12.—*Agricultural cut-over lands in Maine.*

Projects.	County.	Acreage suitable for agriculture.	Estimated acreage available for community settlement.
Cherryfield	Washington	38,000	30,000
Other areas	Various	(1)	.....
Total in State	.....	(1)	.....

[1] Unknown.

MASSACHUSETTS.

GENERAL STATEMENT.

79. *Scope and results of investigations.*—The investigations in this State were conducted almost entirely in cooperation with the Massachusetts State committee. Through the studies of this committee, there were submitted maps showing 17 different tracts of land in 9 different localities involving a total of over 250,000 acres that might, if desirable, be utilized for Government projects. These lands consist of undeveloped swamp lands and occupied and unoccupied valley, hill, and bench lands. Several of these areas were investigated and at least two, and possibly three of them were deemed attractive. These areas are designated the Concord, Neponset, and Cape Cod projects. Further investigations may disclose other tracts either superior to those named or at least suitable for development.

80. *Offers and price of lands.*—Swamp lands range in value from $5 to $25 per acre and cut-over timber lands from $5 to $15 per acre. Cleared cultivated upland is generally valued at about $100 per acre. One offer of a large tract of cut-over land with reasonably good soil and agricultural possibilities was voluntarily made at $6 per acre.

81. *Soils and general agricultural possibilities.*—The soils of Massachusetts are mainly of glacial origin except in the swamps and the reworked soils along the rivers. On the whole, the soils are variable in character, ranging from sandy and gravelly outwash to loamy or clayey till plains or drumlin hills. The loam and clay soils of the till plains are readily cultivable and productive where they do not contain an excess of gravel or bowlders.

LANDS NEEDING DRAINAGE.

CONCORD PROJECT.

82. *Location and acreage.*—The lands of this project are located in the valley of the Concord River in Middlesex County between the towns of Concord and Billerica, and amount in all to about 3,000

acres of swamp lands. Sufficient adjacent uplands can probably be secured to make an area large enough for a desirable project.

83. *Soils and agricultural possibilities.*—The bottom lands are alluvial in character and contain large areas of peat or muck soils and the adjacent uplands are rolling clay to loam hills. It is thought that the lowlands will be quite fertile when reclaimed and suitable for general crop production. The uplands may be utilized for fruit growing and grazing.

84. *Engineering plan and feasibility.*—The drainage of the bottom lands will require the lowering or removal of the dam at Billerica and the substitution of electric power for operation of the woolen mills at that point. Internal drainage of the lands can probably then be obtained by the usual means. Further investigations as to the power needs of the mill and general elevations of the lands are necessary for intelligent conclusions.

85. *Transportation facilities and towns.*—Local transportation facilities are supplied by the Boston & Maine Railroad and good markets exist in the local towns, which in a practical sense include Lowell and Boston.

NEPONSET PROJECT.

86. *Location and acreage.*—The lands of the Neponset project lie just outside of the limits of the city of Boston in the valley of the Neponset River in Norfolk County. The entire area of 9,000 acres is of a swampy character and is bordered by a rather rolling area, a part of which could be coordinated with the lowlands to form a project.

87. *Soils and agricultural possibilities.*—The soils in the swamp consist of a shallow peat or muck and will be excellently adapted to truck raising. The uplands are suitable for building sites, grazing, fruit growing and, limitedly, to general farming. Owing to the nearness of this tract to Boston it appears to have excellent agricultural possibilities for gardening and trucking.

88. *Engineering plan and feasibility.*—The reclamation of these lands would require deepening and straightening of the Neponset River channel and internal drainage for the lands. Whether pumping of drainage water would be required is impossible to state without instrumental investigations, although it is thought that no pumping will be necessary.

89. *Transportation facilities and towns.*—The main line of the New York, New Haven & Hartford Railroad and a branch thereof both pass through the tract, and it is within wagon haul of the center of the city of Boston. Its market possibilities are of the very best.

CUT-OVER LANDS.

CAPE COD PROJECTS.

90. *Location and acreage.*—Running through the central part of Barnstable County from east to west is a strip of upland or bench land now covered with a second growth of coniferous and deciduous trees. This tract is bordered on the west and north by a high rocky ridge and on the south by a strip of sandy foreshore adjacent to the ocean. The bench lands referred to comprise about 60,000 acres that are considered suitable for agricultural purposes.

91. *Soils and agricultural possibilities.*—The bench or table lands of this project consist of a glacial-till plain, and the soils are mainly a sandy loam verging in places into a gravelly loam. The soil works readily and is well suited to fruit growing and to the production of diversified farm crops.

92. *Engineering plan and feasibility.*—The reclamation of this land will consist in clearing it of brush and timber. Here, as in other regions of the cut-over land areas, it is assumed that a reasonable portion of the farms will be cleared immediately and prepared for the growing of crops; that an additional acreage will have the timber and underbrush removed and then be seeded to pasture in order that the roots of the stumps may decay and make it easier to pull them. The growth of timber on this land is of such character as to indicate that it may be cleared within a reasonable cost. It is probable that applications to the land of lime, and possibly also of phosphorus, will be needed to secure good agricultural results.

93. *Transportation facilities and towns.*—A branch of the New York, New Haven & Hartford Railroad passes along the western and northern sides of the tract and crosses it at its eastern end. An extension of another branch through the tract near the western end will be desirable in case of its development. Local markets for crops raised will be provided through small towns and settlements along the seashores, and the entire area is very closely situated with respect to Providence, R. I., and Boston, Mass.

TABLE 13.—*Lands needing drainage in Massachusetts.*

Projects.	County.	Acreage.
Concord	Middlesex	3,000
Neponset	Norfolk	9,000
Scattered small tracts	All	48,000
Estimated total in State		60,000

TABLE 14.—*Agricultural cut-over lands in Massachusetts.*

Projects.	County.	Acreage suitable for agriculture.	Estimated acreage available for community settlement.
Cape Cod	Barnstable	60,000	30,000
Other areas	Various	(1)	.....
Estimated total in State	.....	(1)	.....

[1] Unknown.

MICHIGAN.

GENERAL STATEMENT.

94. *Scope and results of investigations.*—Michigan has a large area of both swamp and unoccupied cut-over lands suitable for agriculture. The cut-over lands cover a large part of the whole area of the

upper peninsula and the whole of the upper part of the lower peninsula. Field investigations indicate that there are approximately 4,200,000 acres of cut-over lands in Michigan suitable for agricultural development and about 2,700,000 acres in addition thereto that are suitable for grazing purposes. (See Table 17, p. 138.) These cut-over lands are held quite extensively in large ownerships, and numerous reasonably contiguous areas suitable for projects can be secured throughout this region. Five projects have been tentatively selected for consideration in the lower peninsula and one in the upper peninsula. These projects are designated and described in the following pages under the respective captions of Au Sable River, Crawford, Gladwin, Manistee River, and Sturgeon River projects for the lower peninsula, and Matchwood for the upper peninsula. In the northern peninsula there are several large swamps, and many small ones are found in both peninsulas. It is estimated in a recent report, made cooperatively by the United States Department of Agriculture and the Michigan Geological and Biological Survey, that there are approximately 2,836,000 acres of these swamp lands reclaimable in the lower peninsula and that there are 2,598,000 acres of swamp and lake area combined in the upper peninsula. (See Table 15, p. 137.) Probably 50 per cent or more of this acreage is now suitable for agricultural development. Of these areas those designated as the Carp River, Cyr, Menominee, Saginaw, Seney, and Tahquamenon areas have been investigated by the northern division of the Reclamation Service. The total area of these swamps is 463,000 acres. Of these areas the Menominee, Saginaw, and Tahquamenon projects are considered most suitable for development, and detailed descriptions of these areas are given in this report.

95. *Offers and prices of land.*—A large number of voluntary offers of lands for soldier-settlement purposes in areas varying from 1,000 to 300,000 acres each, mostly at reasonable prices, have been made by various landholders in this State. Lands suitable for agricultural development range in price from $5 to $35 per acre, depending on the location, agricultural quality, and desire of the owner to dispose of his holdings. Nearly 75 per cent of the entire cut-over area of Michigan is held in large ownerships, and most of the land is for sale.

96. *Soils and agricultural possibilities.*—The soils of Michigan have been formed either from glacial drift deposits, from glacial lake deposits, or from alluvial deposits. The soils range, therefore, from sands up through the various stages of loams and clays of the glacial types. The variability of the soils makes it necessary to investigate each area carefully before its value for reclamation is determined. The different classes of loam and clay soils offer good immediate agricultural possibilities in the cut-over land areas. The swamp lands practically all have peat or muck soils of varying depths with subsoils ranging from pure sand to glacial clay. Careful investigations of their suitability for agriculture must, therefore, be made in each case. Both of the Michigan peninsulas are in the most northerly latitudes of the United States and have, therefore, a comparatively short growing season. However, the climate is greatly modified by the closeness of the lands to the Great Lakes, from which source they derive increased length of growing season and uniformity of climate. Clovers and grasses do especially well

in this region, as do most of the small grains, short-season vegetables, and hardy fruits. Fruits do especially well in the areas adjacent to the lakes. The whole region is well adapted to dairying and grazing.

LANDS NEEDING DRAINAGE.

MENOMINEE PROJECT.

97. *Location and acreage.*—The Menominee project is located along Cedar River and a number of smaller tributaries of Green Bay in Menominee County, Mich., and contains an area of approximately 30,000 acres.

98. *Soils and agricultural possibilities.*—Although the soils of this project are quite diversified they are considered well suited to farming purposes. In general the surface soil consists of shallow peat or muck underlaid with a clay subsoil. Owing to the nearness of the lands to Green Bay this tract is well suited to the production of fruit as well as to the growing of small grains, clovers and grasses, and to the general industry of dairying. About three-fourths of the acreage of the project is owned by three parties.

99. *Engineering plan and feasibility.*—The plan for drainage consists of opening and deepening natural creek channels by means of which it is expected that approximately 75 per cent of the lands will be adequately drained. The plan for reclaiming the remainder of the lands consists in the construction of artificial channels and the installation of such tiling systems as may be necessary to complete the drainage of the lands. Since the area is largely covered with a growth of brush and light timber, slashing and possibly stump-pulling will have to be applied to a large part of the area. Surveys for level determinations for about half of this tract have been completed by the service.

100. *Transportation facilities and towns.*—There are no railroads within the lands of this project but a branch of the Northwestern Railroad passes very close to its western edge and the lands border on Green Bay, where there is opportunity for water transportation. The small towns of Arthur Bay, Cedar River, and Fox lie within the project area. Menominee to the south and Escanaba to the north are towns of considerable size and prominence and are within reasonable reach of this project. Good markets are not far distant in the cities of Chicago and Milwaukee.

SAGINAW PROJECT.

101. *Location and acreage.*—Saginaw project is located in Saginaw and Bay Counties along the lower reaches of the Saginaw River in the vicinity of Saginaw and Bay City. About 90,000 acres of land will either be reclaimed or benefited by the construction of this project. The proposed improvement is also considered to be of material benefit to the town of Saginaw.

102. *Soils and agricultural possibilities.*—These lands lie in the old glacial lake bed surrounding Saginaw Bay, and the primary soils, therefore, belong to the glacial lake and river terrace province. The lake soils have, however, been partly reworked by floods of the Saginaw River, and in places they have been covered by accumu-

lations of peat and muck. In the lower stretches of the valley the soils are largely of a clay character, while those in the upper stretches are more sandy in character. Portions of the valley already developed agriculturally indicate a high soil fertility. This fact, coupled with the location of the lands adjacent to Saginaw Bay and in the midst of a highly developed community, insure good agricultural possibilities for general diversified farming. The lands are largely held in small holdings, some of them being in farms now operated.

103. *Engineering plan and feasibility.*—This plan has not been investigated in detail by the service, but has been reported on by the Office of Public Roads and Rural Engineering of the United States Department of Agriculture. This report indicates that the project is feasible. The plan proposed consists in increasing the size of the channel of Saginaw River and its tributaries and constructing levees along the river and up each tributary as far as necessary for protection from overflow. Drainage of the lands is to be provided by means of pumping plants during floods and by means of sluice gates through the levees at low-water stages. The engineering plan is necessarily a complicated and expensive one, but the expense is probably warranted by the high value of the lands to be reclaimed.

104. *Transportation facilities and towns.*—Splendid transportation facilities are provided by the Michigan Central and Pere Marquette Railroads. Bay City and Saginaw both lie within the area of this project, and there are several smaller towns that add to the urban population. The project is also not far distant from Detroit.

TAHQUAMENON PROJECT.

105. *Location and acreage.*—Tahquamenon project is located in the drainage basin of the Tahquamenon River in Luce and Chippewa Counties and contains approximately 100,000 acres.

106. *Soils and agricultural possibilities.*—Although the soils of this project have not been investigated, the surface soil is supposed to consist mainly of shallow peat and muck underlaid with a clay subsoil. A soil survey is necessary to determine the agricultural qualities of these soils. If the soils prove to be of good quality, the lands are probably well adapted to the growing of small grains, grasses, and short-season vegetables. The tract lies in the most northernly latitudes of the United States and, of course, is limited in the range of crops that can be grown. About 90 per cent of the lands lying within this project are owned by five different parties; the remaining area is held in small ownerships.

107. *Engineering plan and feasibility.*—The swamp area in the Tahquamenon River drainage basin is caused primarily by a rock ledge in the channel at the lower end of the swamp. The preliminary step for reclamation consists in the removal of this ledge to sufficient depth to secure an outlet for the drainage waters. Drainage of the lands will also probably require dredging of the channel of the Tahquamenon River as well as those of its tributaries, and the digging of additional drainage ditches. It is not fully known whether the lands will need tiling, but presumably a portion of them will. From a superficial investigation, all of these engineering features appear to be feasible.

108. *Transportation facilities and towns.*—The lands of this project are traversed by the Duluth, South Shore & Atlantic Railroad near the southern limit of the area. Additional facilities will be necessary for the northern portion of the project in case of its development. The only town of importance within the area of the project is Newberry. Good railroad connections exist between Newberry and Sault Ste. Marie, which is not far distant.

CUT-OVER PROJECTS.

AU SABLE RIVER PROJECT.

109. *Location and acreage.*—The lands of the Au Sable River project are located in the drainage basin of the Au Sable River in Montmorency, Oscoda, Alcona, and Iosco Counties. This tract comprises a fairly compact body of land of 55,000 acres, all of which is owned by one party.

110. *Soils and agricultural possibilities.*—The soils of this tract are variable in character, but it is thought that a sufficient acreage has sandy loam, clay loam, or clay soil to make a good project. Lands with good soils in this locality are adapted to diversified farming and dairying.

111. *Engineering plan and feasibility.*—The reclamation of these lands involves drainage for some of the lowlands and brushing and stumping of the uplands. The cut-over lands were originally mainly timbered with hardwood and pine.

112. *Transportation facilities and towns.*—The Detroit & Mackinac Railroad affords connection with the town of Au Sable on the coast of Lake Huron and a railroad outlet to Detroit. There are numerous small towns scattered throughout the area which, with rail connections to larger cities, will afford markets for such products as are raised.

CRAWFORD PROJECT.

113. *Location and acreage.*—The Crawford project is located on the headwaters of Au Sable River in Crawford County, and contains approximately 14,000 acres in a fairly compact body. This land is owned by one party.

114. *Soils and agricultural possibilities.*—The topography varies from level to rolling, and the soil is clay loam and clay of the glacial morainic type. The lands are adapted to diversified farming, stock-raising, and dairying.

115. *Engineering plan and feasibility.*—Only a small part of the area will need drainage. The lands were originally covered with hardwood and will require the usual methods of land clearing for reclamation.

116. *Transportation facilities and towns.*—This tract is traversed by the Michigan Central Railroad, and all of it lies within a few miles of this line. A few good highways already exist in the area. There are local markets in the small towns scattered through the area, and the Michigan Central Railroad forms a direct outlet to Detroit and other points.

GLADWIN PROJECT.

117. *Location and acreage.*—The Gladwin project contains approximately 25,000 acres of land in a fairly compact body, lying

in the upper drainage basin of the Tittabawassee River in Gladwin County.

118. *Soils and agricultural possibilities.*—The land in this area is mostly of a level character and the soil is apparently largely of a sandy character, with some areas of clay loam and clay.

119. *Engineering plan and feasibility.*—The land has all been cut over and will need brushing and stumping.

120. *Transportation facilities and towns.*—A branch of the Michigan Central Railroad passes through the southern part of this tract and another branch within a short distance of the northern part of the tract. Highway facilities are apparently not of the best. There will be local markets for a portion of the farm products, and railroad outlets to Detroit and other points furnish facilities for outside markets.

MATCHWOOD PROJECT.

121. *Location and acreage.*—The Matchwood project is located on the headwaters of the Ontonagan River in Gogebic and Ontonagan Counties and contains 27,000 acres of land in a compact body, all owned by 41 parties in tracts varying from 160 to 1,000 acres.

122. *Soils and agricultural possibilities.*—The soil consists of clay loam. The agricultural possibilities are considered good for the latitude. The lands of this region are adapted to the growing of small grains, clovers, and grasses, and to the dairying industry.

123. *Engineering plan and feasibility.*—These lands are typical cut-over lands of hardwood interspersed with pine. The plan of reclamation will therefore be the usual one applicable to the cut-over lands of this region.

124. *Transportation facilities and towns.*—This tract is located close to the copper and iron ranges, which provide local markets for farm products. The region is contiguous to the Duluth & South Shore Railroad, which furnishes transportation facilities both to the east and west.

MANISTEE RIVER PROJECT.

125. *Location and acreage.*—This project is located in the drainage basin of the Manistee River in Kalkaska, Muskegon, and Wexford Counties, and may be divided into large reasonably compact areas. The total area is approximately 75,000 acres.

126. *Soils and agricultural possibilities.*—The portion of the project lying in Kalkaska County is of a rolling character, with the exception of occasional swamp areas. The upland soils are largely sandy in character and the swamp soils are peat and muck. The portion of the project in Wexford and Missaukee Counties has a level to rolling topography, and the soils are sand, clay loam, and clay. The lands of the region are adapted to diversified farming, stock raising, and dairying.

127. *Engineering plan and feasibility.*—Small areas of swamp land will require drainage, which can generally be provided through outlets into Manistee River. The remainder of the project will require clearing. The natural timber on a portion of the area consisted of hardwoods; the remainder consisted of timbers prevalent on the sandy soils of this region.

128. *Transportation facilities and towns.*—The transportation facilities should be adequate, as the lands are situated between the Pere

Marquette and Ann Arbor Railroads, and there are numerous highways throughout the area. Local towns furnish markets for a large part of the products, and transportation facilities exist for the shipment of such products as can not be consumed locally.

STURGEON RIVER PROJECT.

129. *Location and acreage.*—The Sturgeon River project is located in Cheboygan, Montmorency, and Otsego Counties in the upper drainage basins of the Sturgeon and Pigeon Rivers. This project contains approximately 30,000 acres of land, lying in a fairly compact body, owned by one party.

130. *Soils and agricultural possibilities.*—Most of the area has a rolling topography and the soil consists of sand, clay loam, and clay. The area is adapted to diversified farming, stock raising, and dairying.

131. *Engineering plan and feasibility.*—Practically all of this area was originally timbered with hardwoods and there are very small acreages within the tract that require drainage. The reclamation will consist of land clearing.

132. *Transportation facilities and towns.*—The Michigan Central Railroad passes through this tract near its western side and also has a branch extending out into the eastern portion of the project. The local markets are adequate for caring for much of the farm products raised here. The Michigan Central Railroad furnishes an outlet to Detroit and other markets.

TABLE 15.—*Lands needing drainage in Michigan.*

Project.	County.	Acreage.
Carp River	Mackinac	120,000
Cyr	Marquette	36,000
Menominee	Menominee	30,000
Saginaw	Saginaw and Bay	90,000
Seney	Schoolcraft	207,000
Tahquamenon	Luce and Chippewa	100,000
Other areas	Various	4,851,000
Estimated total in State		[1] 5,434,000

[1] Total for State furnished by Drainage Investigations, Bureau of Public Roads, U. S. Department of Agriculture, and includes lakes in the northern peninsula, but does not include 1,586,000 acres of clayey land in this peninsula, much of which will need drainage for best results. The acreage for the southern peninsula, comprising a little over half of the total, is the acreage estimated to be reclaimable.

TABLE 16.—*Agricultural cut-over land in Michigan.*

Project.	County.	Acreage suitable for agriculture.	Estimated acreage available for community settlement.
Au Sable	Alcona, Iosco, Oscoda, and Montmorency.	55,000	30,000
Crawford	Crawford	14,000	10,000
Gladwin	Gladwin	25,000	10,000
Manistee	Kalkaska, Muskegon, and Wexford	75,000	25,000
Matchwood	Gogebic-Ontonagan	27,000	20,000
Sturgeon	Cheboygan, Montmorency, and Otsego	30,000	20,000
Total		226,000	115,000
Other areas	Various	3,974,000	.....
Estimated total in State		4,200,000	.....

NOTE.—Probably about 2,000,000 acres available for community settlement in all.

TABLE 17.—*Classified acreages of unoccupied cut-over lands in various counties in cut-over regions of Michigan.*

	Area of unoccupied cut-over lands.	Area most suitable for reforestation.	Area most suitable for agriculture.	Area most suitable for grazing.	Proportion of agricultural lands in large holdings.	Prevailing price of cut-over lands.
Upper peninsula:	*Acres.*	*Acres.*	*Acres.*	*Acres.*	*Per cent.*	
Chippewa	350,000	100,000	160,000	90,000	95	$10.00–$30.00
Mackinac	446,147	183,647	195,000	67,500	75	1.00– 10.00
Luce	350,000	75,000	175,000	100,000	80	2.50– 20.00
Alger	390,000	100,000	180,000	110,000	75	8.00– 20.00
Schoolcraft	500,000	200,000	100,000	200,000	85	7.50
Delta	400,000	50,000	300,000	50,000	75	10.00– 15.00
Marquette	400,000	100,000	150,000	150,000	90	5.00– 20.00
Menominee	469,000	45,000	324,000	100,000	50	10.00– 15.00
Dickinson	450,000	25,000	300,000	125,000	85	5.00– 15.00
Iron	450,000	20,000	300,000	130,000	95	20.00
Baraga	75,000	25,000	50,000	.....	90	6.00– 10.00
Houghton	204,800	32,000	140,800	32,000	90	5.00– 20.00
Ontonagon	350,000	10,000	150,000	190,000	.....	10.00– 20.00
Gogebic	10,000	.....	9,500	300	95	15.00
Total	4,844,947	965,647	2,534,300	1,344,800	.....	.....
Lower peninsula:						
Ottawa	40,000	20,000	5,000	15,000	66	20.00– 30.00
Cheboygan	132,240	15,000	88,160	29,080	80	5.00– 20.00
Presque Isle	150,000	30,000	75,000	45,000	40	10.00– 20.00
Emmet	80,000	24,000	48,000	8,000	20	10.00– 20.00
Charlevoix	138,000	15,000	70,000	53,000	20	10.00– 15.00
Leelanau	40,000	.....	[1] 40,000	.....	75	15.00– 25.00
Antrim	100,000	10,000	50,000	40,000	80	10.00– 15.00
Ostego	130,000	26,000	52,000	52,000	30	8.00– 15.00
Montmorency	150,000	30,000	60,000	60,000	40	10.00– 17.00
Alpena	111,000	22,000	33,300	55,500	50	10.00– 15.00
Alcona	150,000	45,000	45,000	60,000	25	12.00
Oscoda	60,000	15,000	35,000	10,000	40	15.00
Crawford	350,000	25,000	175,000	150,000	10	10.00
Kalkaska	90,000	50,000	18,000	22,000	70	3.00– 10.00
Grand Traverse	120,000	45,000	60,000	15,000	10	12.00– 15.00
Benzie	77,000	26,900	39,700	10,400	75	10.00
Manistee	100,000	30,000	45,000	25,000	40	10.00– 20.00
Wexford	150,000	60,000	10,000	80,000	99	5.00
Missaukee	120,000	35,000	85,000	.....	85	5.00– 15.00
Roscommon	150,000	30,000	45,000	75,000	50	18.00
Ogemaw	121,000	24,200	36,300	60,500	70	15.00– 20.00
Arenac	90,000	18,000	27,000	45,000	50	10.00– 20.00
Gladwin	100,000	10,000	40,000	50,000	75	15.00
Clare	85,000	17,000	25,500	42,500	60	10.00– 20.00
Osceola	21,920	5,000	5,000	11,920	10	5.00– 10.00
Lake	260,000	60,000	50,000	150,000	20	8.00– 15.00
Mason	130,000	70,000	[1] 60,000	.....	80	10.00– 20.00
Newaygo	200,000	.....	100,000	100,000	.....	9.00
Muskegon	130,000	40,000	[1] 90,000	.....	30	5.00– 12.50
Midland	150,000	30,000	45,000	75,000	20	10.00– 15.00
Oceana	40,000	15,000	10,000	15,000	25	10.00– 20.00
Mecosta	75,000	50,000	[1] 25,000	.....	20	10.00– 15.00
Montcalm	55,000	20,000	[1] 35,000	.....	20	15.00
Total	3,896,160	913,300	1,627,960	1,354,900	.....	.....
Grand total	8,741,107	1,878,947	4,162,260	2,699,700	.....	.....

[1] Equally suited for grazing.

MINNESOTA.

GENERAL STATEMENT.

133. *Scope and results of investigations.*—The cut-over lands of Minnesota as well as a large part of unreclaimed swamp lands of the State are located in 20 of the counties in the northeastern part of the State, partly within the drainage area of Hudson Bay, partly within the drainage area of Lake Superior, and partly within the drainage area of the Mississippi River. Nearly all of the land in this section of

the State was originally timber land interspersed with occasional open swamps, but the most of the merchantable timber has been removed, so that the greater part of the entire area consists of cut-over lands and open swamps. Field investigations have disclosed the fact that there are approximately 8,770,000 acres of unoccupied cut-over lands in this part of Minnesota. Of this acreage about 5,350,000 acres are classed as suitable for agricultural purposes and 678,000 acres for grazing purposes. (See Table 20, p. 143.) Two large tracts of these cut-over lands have been selected for investigation and will be described in detail in the following pages under the titles of Kettle River and Whiteface River projects. Numerous other large suitable areas can also be selected without difficulty. The total estimated unreclaimed swamp area of the State, which is largely concentrated in the northern part, amounts to 6,828,000 acres. (See Table 18, p. 143.) A large amount of general drainage work has already been done, but much additional general work as well as detailed work is necessary in order to accomplish complete reclamation of these swamp areas. Four large swamp areas were selected for investigation, and these have been designated as the Koochiching, Red Lake, Roseau River, and St. Louis River projects. The St. Louis River project is situated in an old glacial lake bed in the St. Louis River drainage basin. No detailed investigations have yet been made of this area. The remaining three large swamp areas referred to have been investigated and will be described in detail in the following pages.

134. *Offers and prices of land.*—Several large tracts of cut-over lands in Minnesota were voluntarily offered for soldier-settlement purposes at from $3 to $20 per acre. One desirable tract was priced at $8 per acre and another at $10 per acre, and it is considered certain that no difficulty will be found in securing as many large holdings of suitable land in this State for development for cut-over projects as the Government may wish to undertake. Probably over 60 per cent of the cut-over lands of Minnesota are owned in large holdings and a very large part of these lands is for sale, prices in general ranging from $3 to $25 per acre.

135. *Soils and agricultural possibilities.*—The soils of northern Minnesota all belong either to the glacial province or to the glacial lake province. A large percentage of the swamp lands belong to the latter province. The subsoil in these old lake beds of this province varies from fine clay up to pure sand, but practically the whole swampy region is surfaced with peat and muck soils of varying depths. Some of these soils are readily reducible to agricultural uses, but others contain raw and undecomposed peat difficult readily to reduce to agricultural use. Outside of the swamps the soils consist of morainic gravels, outwash sands, and various classes of loams and clays of the glacial types. The precipitation varies from 25 inches on the western edge of the area to about 36 inches on the eastern edge, and a large percentage of this falls during the growing season. There is seldom any injury either from extreme drouth or from extreme precipitation. The winters are cold and dry and the summers warm. The region is well adapted to the growing of grasses, clovers, small grains, vegetables, and hardy fruits. Grasses and clovers are especially at home here, and dairying is one of the most promising farm industries.

LANDS NEEDING DRAINAGE.

KOOCHICHING PROJECT.

136. *Location and acreage.*—The Koochiching project is situated in the northern part of Koochiching County, in the drainage basins of Black and Rapid Rivers. It contains approximately 200,000 acres of swamp land, about 90,000 acres of which are still owned by the United States.

137. *Soils and agricultural possibilities.*—The surface soil of practically the entire area consists of deep peat underlaid with a subsoil either of clay or sand. Owing to the depth of the peat, the extreme northern latitude, and the timbered character of the land, this tract is not considered suitable for development for agricultural use at the present time.

138. *Engineering plan and feasibility.*—A general investigation of this area was made which indicates that the scheme of drainage will involve the use of the existing channels of Black and Rapid Rivers for main outlets and of connecting drainage ditches extending into the broad, flat swamp areas. Although the land in general is flat, it appears to have sufficient slope for good drainage.

139. *Transportation facilities and towns.*—The transportation facilities for the lands of this project are not satisfactory. The Minnesota, Dakota & Western Railroad extends from Nakoda, a point on the Minnesota & International Falls Railroad, to Loman, at the extreme eastern border of the project. An extension of this railroad through the project, with a spur from some point on the Minnesota & International Falls Railroad northward into the project area, will be needed for the purpose of giving needed transportation facilities. The only town now with railroad service within reach of this project is Loman.

RED LAKE PROJECT.

140. *Location and acreage.*—The lands of the Red Lake project lie in the Chippewa Indian Reservation, in Beltrami County, along the Red Lake River west of Red Lake and north of the lake, partly within the drainage area of the lake and partly within the drainage area of Rapid River, a tributary of Rainy River. The total area of the project is approximately 440,000 acres, of which 275,000 lie within the present Red Lake Indian Reservation and 165,000 outside of the reservation north of Red Lake. Of the 165,000 acres north of the lake, about 110,000 acres lie within the drainage basin of the lake and 55,000 acres within the drainage basin of Rapid River. The lands within the Indian reservation are the property of the Chippewa Indians. The area lying without this reservation is public land. Some of these Government lands have been partly drained by the State of Minnesota and are subject to drainage taxes under the Volstead Act of 1898.

141. *Soils and agricultural possibilities.*—In the area north of Red Lake the surface soil consists of deep peat and the subsoil of either clay, sand, or gravel. About one-third of this area is timbered; the remainder consists of open swamp land. In the Indian reservation the lands are of the more open type, and the peat is shallower and the underlying subsoil is more generally of a clayey character. Considerable question exists at the present time from an economical standpoint as to the successful agricultural development of the deep

peat areas. The area within the Indian reservation, where the peat deposits are shallower and where the subsoil conditions are more favorable, has better agricultural possibilities. Lands lying to the west of the Indian reservation of similar character have been drained and are now proving valuable agricultural lands.

142. *Engineering plan and feasibility.*—A general field investigation was made of this project and studies were made from existing data as to plans for development. Drainage of these lands will require the lowering and controlling of the outlet of Red Lake into Red Lake River, the improving of Red Lake River channel, and the construction of necessary drainage ditches through the lands. The lands lying in the Rapid River drainage basin will of course have their natural outlet through Rapid River and drainage ditches connected with it. From an engineering viewpoint the plan of reclamation appears feasible so far as present investigations indicate.

143. *Transportation facilities and towns.*—The present transportation facilities of this project are inadequate. An extension of the Thief Falls-Torgenson electric line eastward into the project area and an extension of a line from the Minnesota & International Falls Railroad westward are necessary. There are several inland towns of small importance scattered throughout the area of the project, but the development of towns along the suggested railroad extensions will be a necessary part of the proposed development of the project.

ROSEAU RIVER PROJECT.

144. *Location and acreage.*—The Roseau River project is located in Roseau County along the Roseau River, adjacent to Canada, and contains approximately 110,000 acres of swamp and overflow lands. About 60,000 acres of these lands have already been partially reclaimed by general drainage ditches, and about 50,000 acres are entirely without present drainage facilities. Fifty per cent or more of the lands are owned by the State of Minnesota.

145. *Soils and agricultural possibilities.*—The surface soil consists of peat, varying from 1 to 3 feet in depth, and the subsoils consist of clay with occasional beds of sand and gravel interspersed. The agricultural possibilities from a soil viewpoint are good, but they are limited in the character of crops adaptable to the northern location of the lands. However, small grains, grasses, clovers, and short-season vegetables can be grown in this area.

146. *Engineering plan and feasibility.*—The plan of reclamation involves the diversion of a portion of the flood flow of Roseau River into Two River, thence into the Red River, and the construction of a system of drains north of Roseau River. The lower end of Roseau River passes through Canada before entering Red River, hence the project assumes an international aspect. A general reconnaissance of this project and a survey for locating a feasible channel for diversion of the Roseau River into Two River, together with a survey of the Two River channel to its conjunction with Red River, have been made. The results of the survey indicate that the proposed diversion of Roseau River is a feasible proposition.

147. *Transportation facilities and towns.*—A branch of the Great Northern Railroad extending from Thief River Falls to Warroad passes along the southeastern side of the project. Additional railroad service within the project area will be needed in case of its de-

velopment. The principal towns within reach of the project are Greenbush and Roseau, and additional towns will be necessary for successful colonization of the project.

CUT-OVER LANDS.

KETTLE RIVER PROJECT.

148. *Location and acreage.*—The Kettle River project is located on the headwaters of Kettle River in Aitkin and Carlton Counties and contains approximately 89,000 acres of land, mainly held in three large ownerships.

149. *Soils and agricultural possibilities.*—The western portion of the project is comparatively level, needs drainage, and has a peat or muck soil. The eastern part is rolling upland and has a sandy loam soil. The lands are adapted to diversified farming, particularly to the production of potatoes, small grains, clovers, and grasses. The region is well suited to the dairy industry.

150. *Engineering plan and feasibility.*—Some drainage work of a general character has already been done on the lowlands, but an additional and more detailed drainage system must be provided. The remainder of the project will require brushing and stumping along the lines proposed for the development of such lands. The lowlands consist partly of grass-covered swamps and partly of swamps covered with tamarack, cedar, and spruce trees. The upland areas were originally mostly timbered with hardwoods and white pines.

151. *Transportation facilities and towns.*—The lands of this project are accessible from both the Soo line and the Northern Pacific railroads, and they are fairly well provided with highways. Local markets exist for a portion of the products. The remainder thereof will find good markets in Duluth, St. Paul, and Minneapolis.

WHITEFACE RIVER PROJECT.

152. *Location and acreage.*—The Whiteface River project contains approximately 48,000 acres of land in St. Louis County, mainly surrounding the headwaters of Whiteface River and Bay Creek, a branch of Cloquet River. The lands of this project are mainly owned by two parties.

153. *Soils and agricultural possibilities.*—A considerable portion of the land is comparatively level and of swampy type. The remainder consists of level rolling uplands. In the swamp area the surface soils consist mostly of peat and muck. The soils on the uplands are clay loam. These lands are considered to be suitable for general farming purposes, and are particularly adapted to the growing of potatoes, small grains, grasses, and clovers. Dairying is a promising industry.

154. *Engineering plan and feasibility.*—Although detailed investigations have not been made as to the possibility of drainage of the lowlands, general observations indicate that there will be no difficulty in securing the proper drainage of these lands. The lowlands consist either of open grass marshes or original growth of cedar, tamarack, and spruce, or have been cut over. The uplands were originally timbered with hardwoods and white pines. The usual methods of brushing and stumping will of course be necessary for reclamation of the uplands.

155. *Transportation facilities and towns.*—The Duluth, Winnipeg & Pacific Railroad and also the Duluth & Northwestern Railroad pass through this tract. As yet there are very meager highway facilities. The local iron industries and the towns of Duluth and Superior will provide outlets for the produce.

TABLE 18.—*Lands needing drainage in Minnesota.*

Project.	County.	Acreage.
Bois de Sioux	Wilkin and Traverse	25,000
Koochiching	Koochiching	200,000
Red Lake	Beltrami-Clearwater	440,000
Roseau	Roseau-Kittson	110,000
St. Louis	St. Louis	200,000
Other areas	Various	5,853,000
Estimated total in State		[1] 6,828,000

[1] Total for State furnished by Drainage Investigations, Bureau of Public Roads, U. S. Department of Agriculture.

TABLE 19.—*Agricultural cut-over lands in Minnesota.*

Project.	County.	Acreage suitable for agriculture.	Estimated acreage available for community settlement.
Kettle River	Carleton-Aitkin	89,000	45,000
Whiteface River	St. Louis	48,000	25,000
		137,000	70,000
Other areas	Various	5,163,000	.....
Estimated total in State		5,300,000	.....

TABLE 20.—*Classification of unoccupied cut-over lands in various counties in cut-over regions of Minnesota.*

County.	Area of unoccupied cut-over lands.	Area most suitable for reforestation.	Area most suitable for agriculture.	Area most suitable for grazing	Proportion of agricultural lands in large holdings.	Prevailing price of cut-over lands.
	Acres.	*Acres.*	*Acres.*	*Acres.*	*Per cent.*	
Cook	889,351	533,611	177,870	.....	80	$3.00–$5.00
Lake	1,220,892	308,355	456,263	.....	70	3.00–10.00
St. Louis	1,497,231	726,667	770,564	.....	65	2.00–20.00
Koochiching	5,000	.....	4,000	1,000	90	5.00
Clearwater	25,000	.....	15,000	10,000	95	10.00
Itasca	1,000,000	10,000	900,000	90,000	50	12.00–20.00
Carlton	184,000	15,000	100,000	69,000	25	10.00–20.00
Aitkin	1,047,600	.....	1,047,600	.....	25	7.50
Cass	780,000	65,000	665,000	50,000	72	12.00
Hubbard	280,000	60,000	120,000	100,000	80	8.00
Becker	250,000	50,000	75,000	125,000	70	4.00–25.00
Otter Tail	57,500	3,500	45,000	9,000	30	12.50–25.00
Wadena	115,000	5,000	90,000	20,000	30	10.00–25.00
Crow Wing	347,000	197,000	150,000	.....	75	8.00–15.00
Pine	200,000	25,000	175,000	.....	25	15.00–25.00
Kanabec	150,000	5,000	130,000	15,000	60	12.00–20.00
Mille Lacs	195,000	8,000	147,000	40,000	50	17.50
Morrison	268,569	40,285	134,284	94,000	30	15.00–25.00
Todd	55,000	3,000	47,000	5,000	25	15.00–25.00
Beltrami	200,000	50,000	100,000	50,000	25	8.00–15.00
Total	8,767,143	2,105,418	5,349,581	678,000	.....	.....

MISSOURI.

GENERAL STATEMENT.

156. *Scope and results of investigations.*—There are large possibilities in Missouri for development of both cut-over lands and lands needing drainage. The bottom-land areas of the Mississippi and Missouri Rivers and their tributaries furnish large acreages of lands either originally swampy or subject to overflow, while the timbered region of the Ozark Mountains contains very large acreages of cut-over lands. The lands needing drainage were investigated and reported on in three groups: The northeastern group, covering the Mississippi River and its tributaries between Keokuk and St. Louis; the southeastern group, covering the Mississippi River and its tributaries south of St. Louis; and the Missouri River group, covering the Missouri River and its tributaries. These investigations indicate that the first group contains approximately 100,000 acres, the second group approximately 900,000 acres, and the third group approximately 1,000,000 acres. These figures indicate a total unreclaimed and partially reclaimed area of 2,000,000 acres, not including farm lands needing tiling. Four large areas of these lands comprising about 910,000 acres, are considered worthy of further investigation, and it is probable that additional study will disclose other large areas. Three of these areas lie in the lowland section of southeastern Missouri, and one of them lies in the Mississippi Valley near the mouth of the Cuivre River. Each of these areas will be taken up and discussed in detail in subsequent pages of this report. In the line of unoccupied cut-over lands, there are over 13,000,000 acres in Missouri in the Ozark region, of which approximately 3,000,000 acres are considered to be suitable for agriculture and 7,000,000 for grazing. (See Table 23, p. 148.) Although no definite cut-over project was selected for investigation in this region, yet it is known that several suitable areas can be found.

157. *Offers and prices of land.*—Numerous offers of small tracts of land and several offers of large tracts were voluntarily made at prices ranging from $5 to $12.50 per acre for lands in the Ozark region and $20 to $100 in the lowland region of southeastern Missouri. As a general proposition the unimproved cut-over lands or the Ozark region are valued at from $5 to $10 per acre. Approximately one-half of the area of cut-over lands of the Ozark region and a little smaller proportion of those of the lowlands of southeastern Missouri are held in large ownerships.

158. *Soils and agricultural possibilities.*—The soils of the Ozark Mountain region belong to the upland portion of the limestone valley and upland province and are of a residual character, having been formed by the decomposition of the underlying cherty limestone; or, more limitedly, of sandstone, shale, and chert-free limestone. Surrounding the higher areas of the Ozarks is a bordering strip of soils moderately free from chert. Within this area in the higher altitudes the soils contain large quantities of chert. The cherty soils of the higher altitudes have a lower agricultural value than the chert-free soils of the lower altitudes. In texture, these soils are almost universally silty, while those of the subsoils are silty or silty clay in character. Leaching processes have, in a large meas-

ure, caused a deficiency of lime and phosphorus in these soils. The Ozark region is adapted to fruit growing, diversified farming, dairying, and stock raising. The soils of the lands needing drainage are mainly of an alluvial character and consist of clays, silt loam, loam, and sandy loam, and are productive, as a rule.

LANDS NEEDING DRAINAGE.

BLACK RIVER PROJECT.

159. *Location and acreage.*—The Black River project is located in southeastern Missouri in the Black River and St. Francis River Valleys and comprises approximately 425,000 acres of land. Of this area about 222,000 acres are estimated to be available for settlement; the remainder of the area is occupied. The whole area has been included in various drainage districts, but only very imperfect reclamation has been accomplished. About 1,085,000 acres in the valleys of the Black and St. Francis Rivers in Arkansas are inseparably connected with the Missouri area in any intelligent scheme of reclamation. Of this area about 519,000 acres are available for settlement. The total project area in both States is therefore about 1,510,000 acres, of which 741,000 acres are available for settlement.

160. *Soils and agricultural possibilities.*—The lands in this project are low lying and flat, sloping toward the southwest at the rate of 1 to 2 feet to the mile. The water channels are crooked and inadequate and the lands are subject to overflow at high-water stages. The soils are a result of the overflow of the various rivers and consist of a fertile silt loam, with scattered areas of white clay suited only for rice culture. The agricultural possibilities in general are excellent. Cotton, corn, small grains, and grasses are the principal crops of this region.

161. *Engineering plan and feasibility.*—The plan of reclamation consists in the construction of a reservoir of 600,000 to 800,000 acre-feet capacity adjacent to the foothills connecting the Black and St. Francis Rivers or of individual reservoirs on each of these rivers in the hills; the discharge of the stored waters either through the Little River drainage district floodway into the Mississippi River below Cape Girardeau or through a channel from the reservoir to Cache River, thence into the White River, or by liberating the flood waters gradually into St. Francis and Black Rivers. Preliminary investigations indicate this plan of reclamation to be feasible. This is a very complicated project, however, and run-off records are inadequate for a proper study of the situation. Further investigations are therefore necessary to determine the economical feasibility of the suggested plans. In their native state these lands were all forested with red gum, oak, and ash on the dryer areas and with tupelo gum and cypress on the wetter areas. Clearing is therefore a part of the required reclamation scheme.

162. *Transportation facilities and towns.*—Transportation by means of the Missouri Pacific and St. Louis & San Francisco Railroads and branches thereof are excellent. None of the land of the project is more than one or two hours' wagon haul from a railroad station. Transportation through the Mississippi River by means of

large canals into the project area is also a possibility. There are numerous towns of considerable size and importance scattered throughout the area, and good transportation facilities, connecting the area with both Memphis and St. Louis, exist.

ELK CHUTE PROJECT.

163. *Location and acreage.*—The Elk Chute project consists of about 340,000 acres of land lying in Dunklin and Pemiscot Counties in the lower stretch of Little River Valley and east thereof to the Mississippi River. Of this area about 125,000 acres are still uncleared and will undoubtedly be available in a large measure for settlement. The lands referred to now include six drainage districts already organized but with drainage works inadequate for the complete reclamation of the lands within their boundaries.

164. *Soils and agricultural possibilities.*—The soil in the western part of Elk Chute project consists of clay loam, while that in the remaining portion of the area consists of fine sandy loam. The clay loam is excellent soil, and the sandy loam is also fertile, but in some parts of the area it contains sandy areas of less valuable quality. Corn and wheat do well on the clay-loam soils, and cotton, corn, peas, and melons do well on the sandy loams. The agricultural possibilities of the area are considered good.

165. *Engineering plan and feasibility.*—The entire area of this project has adequate levee protection along the Mississippi River, with a connecting spur extending to Sikeston Ridge. For the eastern portion of the land the existing drainage works need amplifying by enlarging and deepening the drainage ditches and by extending and enlarging the outlets. About 60,000 acres of the area adjacent to Little River require levee protection from high-water stages of Little River and internal drainage with pumping facilities for use during high stages of Little River. The unoccupied lands of the area are timbered with the species of trees prevalent in this region, and the lands will, therefore, require clearing as well as protection from overflow.

166. *Transportation facilities and towns.*—Branches of the Missouri Pacific and St. Louis & San Francisco Railroads serve the lands of this project, and they are within reasonable distance of the Mississippi River where transportation by navigation is available. There is a number of small towns scattered throughout the project which, together with St. Louis and Memphis, furnish outlets for produce.

NEW MADRID PROJECT.

167. *General statement.*—There are approximately 100,000 acres of land in southern Mississippi and eastern New Madrid Counties that require additional reclamation. The present inadequate drainage systems need supplementing with intercepting canals, collection ditches, and pumping plants to care for internal drainage at high-water stages. The lands of this project are now behind good levees, protecting them from overflow from the Mississippi River. The cost of reclamation probably will be high owing to the necessity of the use of pumping plants for disposing of the drainage waters. It is estimated that approximately 30,000 acres of these lands might be available for settlement.

ST. CHARLES PROJECT.

168. *Location and acreage.*—St. Charles project comprises lands in the Mississippi River bottom on the west side of the river extending from a few miles above the channel of Bobbs Creek to a short distance below the channel of Dardenne Creek. The whole tract covers about 45,000 acres of land subject to overflow, now mostly under under cultivation but seriously hampered by occasional high-water stages. A portion of the area is in the Dardenne-Peruque drainage district. Further investigations are necessary to determine whether any of the lands will be available at reasonable prices for settlement.

169. *Soils and agricultural possibilities.*—The soils of this project consist of fine sandy loam near the streams and of silty clay or gumbo in level or depressed areas, with silty loam areas lying between the other two classes. When properly drained, these soils are suitable for the production of corn, wheat, oats, clover, timothy, and alfalfa. With adequate drainage the lands of the entire area are considered to have good agricultural possibilities.

170. *Engineering plan and feasibility.*—The plan of reclamation consists in building levees along the Mississippi River and up the Cuivre River, and Bobbs, Peruque, and Dardenne Creeks, providing internal drainage ditches with outlets through the levees and possibly also installing pumping equipment for handling drainage water during high-water stages.

171. *Transportation facilities and towns.*—Railroad facilities are supplied through the St. Paul-St. Louis line of the Chicago, Burlington & Quincy Railroad and the St. Louis-Kansas City branch of the Wabash Railroad. This tract of land is located close to St. Louis, which furnishes an excellent outlet for the crops produced.

MISSOURI RIVER PROJECTS.

172. *General statement.*—Along the Missouri River and its tributaries there are a great many areas needing drainage. The preliminary investigations indicate the existence of as much as 1,000,000 acres of land here that either have not been reclaimed or have been very imperfectly drained. However, the lands are mostly not swampy in character but are subject to overflow in wet seasons, and are generally otherwise occupied and cultivated. Further investigations should be made here to determine the location and feasibility of projects and the availability of the lands for settlement.

TABLE 21.—*Lands needing drainage in Missouri.*

Projects.	County.	Acreage.
Black River	Butler, Stoddard, Dunklin	425,000
Elk Chute	Dunklin, Pemiscott	340,000
New Madrid	New Madrid	100,000
St. Charles	St. Charles, Lincoln	45,000
Missouri River	Several	1,000,000
Other areas	Various	90,000
Estimated total in State		2,000,000

TABLE 22.—*Agricultural cut-over lands in Missouri.*

Project.	County.	Acreage suitable for agriculture.
Ozark Region	Various	3,000,000
Estimated total in State		3,000,000

Estimated acreage available for community settlement unknown; probably about 1,500,000 acres available for community settlement.

TABLE 23.—*Classified acreages of unoccupied cut-over lands in various counties in Ozark cut-over regions of Missouri.*

Counties.	Area of unoccupied cut-over lands.	Area most suitable for reforestation.	Area most suitable for agriculture.	Area most suitable for grazing.	Proportion of agricultural lands in large holdings.	Prevailing price of cut-over lands.
	Acres.	*Acres.*	*Acres.*	*Acres.*	*Per cent.*	
Berry	284,000	56,800	142,000	85,200	50	$5–10
Benton	252,000	37,800	151,200	63,000	50	5–10
Bollinger	240,000	36,000	144,000	60,000	50	5–10
Camden	339,000	50,850	203,400	84,750	50	5–10
Cape Girardeau	146,000	21,900	87,600	36,500	50	5–10
Carter	295,000	73,750	147,500	73,750	50	5–10
Cedar	116,000	17,400	69,600	29,000	50	5–10
Christian	195,000	48,750	97,500	48,750	50	5–10
Cole	120,000	18,000	72,000	30,000	50	5–10
Crawford	360,000	72,000	180,000	108,000	50	5–10
Dade	89,000	13,350	53,400	22,250	50	5–10
Dallas	193,000	38,600	96,500	57,900	50	5–10
Dent	360,000	72,000	180,000	108,000	50	5–10
Douglas	364,000	72,800	182,000	109,200	50	5–10
Franklin	285,000	57,000	142,500	85,500	50	5–10
Gasconade	203,000	40,600	101,500	60,900	50	5–10
Greene	123,000	30,750	61,500	30,750	50	5–10
Henry	100,000	25,000	50,000	25,000	50	5–10
Hickory	145,000	29,000	72,500	43,500	50	5–10
Howell	410,000	82,000	205,000	123,000	50	5–10
Iron	305,000	76,250	122,000	103,750	50	5–10
Jasper	134,000	26,800	67,000	40,200	50	5–10
Jefferson	263,000	52,600	131,500	78,900	50	5–10
Laclede	312,000	62,400	156,000	93,600	50	5–10
Lawrence	98,000	24,500	39,200	34,300	50	5–10
McDonald	231,000	57,750	92,400	80,850	50	5–10
Madison	252,000	63,000	100,800	88,200	50	5–10
Maries	205,000	41,200	82,400	82,400	50	5–10
Miller	133,000	26,600	53,200	53,200	50	5–10
Moniteau	72,000	14,400	28,800	28,800	50	5–10
Morgan	237,000	47,400	94,800	94,800	50	5–10
Newton	179,000	35,800	89,500	53,700	50	5–10
Oregon	385,000	77,200	154,400	154,400	50	5–10
Osage	133,000	26,600	53,200	53,200	50	5–10
Ozark	351,000	87,750	140,400	122,850	50	5–10
Perry	148,000	29,600	59,200	59,200	50	5–10
Phelps	303,000	60,600	121,200	121,200	50	5–10
Polk	153,000	22,950	91,800	38,250	50	5–10
Pulaski	254,000	50,800	127,000	76,200	50	5–10
Reynolds	471,000	117,750	188,400	164,850	50	5–10
Ripley	323,000	64,600	129,200	129,200	50	5–10
St. Clair	203,000	40,600	81,200	81,200	50	5–10
St. Francois	197,000	49,250	78,800	68,950	50	5–10
Ste. Genevieve	202,000	50,500	80,800	70,700	50	5–10
Shannon	571,000	142,750	228,400	199,850	50	5–10
Stone	237,000	59,250	94,800	82,950	50	5–10
Taney	350,000	87,500	140,000	122,500	50	5–10
Texas	537,000	80,550	268,500	187,950	50	5–10
Vernon	117,000	17,550	70,200	29,250	50	5–10
Washington	403,000	100,750	161,200	141,050	50	5–10
Wayne	378,000	94,500	151,200	132,300	50	5–10
Webster	195,000	29,250	97,500	68,250	50	5–10
Wright	268,000	40,200	134,000	93,800	50	5–10
Total	13,221,000	2,753,550	[1] 6,148,700	[1] 4,318,750		
Corrected areas			3,084,350	7,383,100		

[1] It is considered that the estimated cut-over area suitable for agriculture is too high and that of the area suitable for grazing is too low, hence the estimated corrected figures. Eleven of these estimates are very rough and subject to large corrections after further investigation.

MONTANA.

GENERAL STATEMENT.

173. *Scope and results of investigations.*—The work done by the northern division in Montana covers only cut-over lands. The lands needing irrigation and those needing drainage were investigated by the western division and will be included in the report of that division. The principal areas of cut-over lands lie in the western part of the State and such of these lands as are suitable for agriculture are situated chiefly in the river valleys. It is estimated that the total cut-over area of Montana is 695,000 acres, of which 312,000 acres are considered suitable for agriculture. (See Table 25, p. 152.) Studies have been made and general data collected for six areas of these agricultural lands. The four most important of these consist of what has been designated as the Clark Fork and Kalispell projects in the drainage basin of Clark Fork and the Fortine and Libby projects in the drainage basin of the Kootenai River. For convenience the two projects referred to lying in the drainage basin of Clark Fork will be discussed together and the two lying in the Kootenai River basin will be likewise treated. There is a small area lying in the Swan River Valley that contains approximately 5,000 acres of cut-over lands, but owing to the smallness of the area this is omitted from the detailed discussions. There is also an area of approximately 50,000 acres on the south side of the Bitter Root River, but this land will probably require irrigation. About 10,000 acres of it will require draining. The remaining 40,000 acres are covered with brush with no stumps. This area is also omitted from the detailed discussions.

174. *Offers and prices of land.*—Several voluntary offers were made of large holdings of lands in connection with the various areas referred to in the preceding paragraph. Unimproved cut-over lands of this region suitable for agricultural use vary from $5 to $20 per acre and improved lands from $25 to $75 per acre, except under irrigation, where the prices are higher. Doubtless no difficulty would be experienced in obtaining areas at reasonable prices large enough for settlement in the four projects referred to.

175. *Soils and agricultural possibilities.*—The areas suitable for agriculture in western Montana lie mainly in the river valleys and adjacent areas. The valleys have practically all been affected by glacial action and the topography of the agricultural lands consists of the present alluvial river bottoms and of higher bordering river terraces of old glacial lake beds. The soils vary, therefore, from fine sandy loam and heavy silt loam to lake-laid silty clay and are generally very fertile. In some places the original glacial till overtops the terraces and there is considerable gravel and bowlders in the soil. Irrigation is generally a valuable adjunct to the rainfall in crop production in this region.

CUT-OVER LANDS.

CLARK FORK PROJECTS.

176. *Location and acreage.*—The Clark Fork unit lies in the valley of Clark Fork River between Paradise and the boundary line between Montana and Idaho. Of this area there are 55,000 acres of logged-

off lands, of which 25,000 acres are now under cultivation and 20,000 acres are presumably available for community settlement. The Kalispell unit of the Clark Fork group is located in the valley of Flathead River and its tributaries, in a large, flat inter-mountain area lying to the north of Flathead Lake which was, presumably, at one time a portion of that lake. It is estimated that there are approximately 130,000 acres of agricultural land within this unit, of which 75,000 acres are now under cultivation and 55,000 acres are unoccupied stump land owned in small tracts. It is not known whether or not these small holdings can be acquired for settlement.

177. *Soils and agricultural possibilities.*—The soils of the Clark Fork unit range from a silty and fine sandy loam to such soils with admixtures of bowlders; those of Kalispell unit consist mainly of lake-laid silt and fine sandy loam in the central portions of the unit with admixtures of stones in the glaciated borders of the old lake bed. The principal crops adaptable to these areas are grains, hay, hardy vegetables, and the hardier fruits. The winters of this region are usually cold, reaching as low as 20° below zero on the coldest days on the Clark Fork unit and as low as 25° to 35° below zero on the Kalispell unit. The summers are warm and the nights are generally cool. The months of July and August are usually dry. The average annual precipitation within the Clark Fork unit varies from about 20 to 22 inches, being lighter at the upper end of the valley and heavier at the lower end. Within the Kalispell unit the average annual precipitation is probably about 18 to 20 inches. In both regions irrigation is a beneficial adjunct to rainfall in the processes of agriculture.

178. *Engineering plan and feasibility.*—If development is made without irrigation the plans of reclamation will consist of clearing the land, subdividing it, and putting it into condition for occupancy. The original timber cut from the lands consisted of pines, firs, spruce, hemlock, and larch. Except where there is too large a percentage of larch and where the stumps are too thickly distributed over the ground it is believed that reclamation can be secured at economical costs.

179. *Transportation facilities and towns.*—The Clark Fork unit is traversed from one end to the other by the Northern Pacific Railroad and contains a number of small towns at intervals, the principal one being Thompson Falls. The main line of the Northern Pacific Railroad passes through the northern end of the Kalispell unit and has a branch extending from Columbia Falls southward through the central part of the unit to Kalispell and Somers. There are several small towns within the project area, the principal of which is Kalispell. Lumbering, mining, and stock-raising industries furnish local markets for a large proportion of the agricultural products raised, while the main-line railroads traversing the projects furnish outlets for distant markets.

KOOTENAI PROJECTS.

180. *Location and acreage.*—The Fortine unit is located along the Tobacco River, Fortine Creek, and the Kootenai River near the mouth of Tobacco River. The project contains approximately 35,000 acres of logged-off lands lying southeastward of Eureka, in the

vicinity of Fortine, a portion of which is available for community settlement. The Libby unit consists of three isolated tracts located in the valley of the Kootenai River and extending up the Fisher River, Libby Creek, and Lake Creek, and it contains approximately 30,000 acres of logged-off land, a large percentage of which is available for community settlement.

181. *Soils and agricultural possibilities.*—The soils are of glacial origin, varying from a silty fine sandy loam on the Libby unit with admixtures of stones in the upland terrace areas to a heavy silt loam of river deposits, lake-laid deposits, glacial terrace deposit, and glacial till with admixtures of stones. The soils are generally fertile. On the Libby unit the winters are comparatively mild, with heavy snowfall. The growing season is comparatively short and July and August are usually dry. In the Fortine unit the temperatures are much more severe, the winters being long and cold. The temperature ranges as low as 40° below zero, with heavy snowfall. The summers are short, hot, and dry. The growing season is also short. Small grains and the hardier vegetables and hay are the principal crops adapted to the region.

182. *Engineering plan and feasibility.*—Unless irrigation is adopted as a part of the scheme of reclamation, these lands will require only clearing of pine, spruce, hemlock, and larch stumps. The cost of reclamation depends on the number and size of stumps and the preponderance of different species of trees. Where the conditions are not too unfavorable it is believed that the clearing can be done for economical cost.

183. *Transportation facilities and towns.*—The main line of the Great Northern Railroad runs through the Fortine unit from one end to the other and passes down the Kootenai River along the edges of the three segregated areas of the Libby unit. Fortine and Eureka are the principal towns within the Fortine unit, and Fortine, Libby, and Troy within the Libby unit. Local industries furnish markets for a large proportion of the agricultural products, while the main line of the Great Northern Railroad will furnish outlet to distant markets.

TABLE 24.—*Agricultural cut-over lands in Montana.*

Projects.	County.	Acreage suitable for agriculture.	Estimated acreage available for community settlement.
Clark Fork	Sanders	55,000	20,000
Kalispell	Flathead	55,000	30,000
Fortine	Lincoln	35,000	25,000
Libby	do	30,000	20,000
Total		175,000	95,000
Other areas	Various	137,000	.....
Estimated total in State		312,000	.....

TABLE 25.—*Classified acreages of unoccupied cut-over lands in various counties of cut-over regions of Montana.*

Counties.	Area of unoccupied cut-over lands.	Area most suitable for agriculture.	Counties.	Area of unoccupied cut-over lands.	Area most suitable for agriculture.
Beaver	2,000	.....	Powell	67,000	27,000
Flathead	150,000	90,000	Ravelli	117,000	41,000
Granite	20,000	.....	Sanders	103,000	55,000
Lincoln	96,000	43,000			
Missoula	140,000	56,000	Total	695,000	312,000

NEW HAMPSHIRE.

GENERAL STATEMENT.

185. *Scope and results of investigations.*—New Hampshire is largely a rolling or mountainous country, so that the lands adapted to general farming form but a comparatively small portion of the State. Lumbering is still an extensive industry in the northeast section, while the southeastern and southern portions are particularly suited for fruit raising. A large area in the west central part of the State is largely devoted to live stock and pasture lands. The best dairy lands lie in a narrow strip all along the Connecticut River Valley. The Merrimac River furnishes a broad valley of lighter soils where the use of large farming machinery is possible. The State is estimated to contain about 19,000 acres of swamp lands and about 2,600,000 acres of unoccupied cut-over lands. No lands needing drainage suitable for a project were located and only one possible project of cut-over lands was investigated.

186. *Offers and prices of lands.*—One tract designated as the Nashua project has been brought to the attention of the department. Other than this tract the vacant-farm proposition is the only one presented. It is found that fair unimproved farming land may be procured at from $5 to $10 per acre. Improved New Hampshire farms are valued at $25 to $40 per acre.

187. *Soils and general agricultural possibilities.*—The soil of the State shows the effect of glacial action on granite and a partial reworking by the river of the glacial deposits. The result is a considerable variety of productiveness, the more fertile soils being along the slower streams. The soils of the valleys, coastal plains, and rounded hills are relatively fertile. The rocky and mountainous highlands discourage the extensive use of farm machinery and encourage pasturage and permanent meadows rather than grain growing or the culture of other crops. The present trend of agriculture is toward dairying, fruit growing, and, in the southern part, trucking.

CUT-OVER LANDS.

NASHUA PROJECT.

188. *Location and acreage.*—This tract lies in the Souhegan River and Pennichuck Brook Valleys in Hillsboro County, extending in a northwest and southeast direction from Nashua to Wilton, some 15 miles distant. There are about 10,000 acres in the tract.

189. *Soils and agricultural possibilities.*—The lands are of terrace formation and the soils consist largely of coarse sand and gravelly sandy loam, as well as some fine sandy loam and stony loam having subsoils, respectively, of coarse sand and sand and gravel, sandy loam, fine sandy loam, and sandy loam. The soils are therefore drouthy and leachy in character and will require humus and fertilizers to build them up. These soils are early, however, and may be adapted to trucking crops, especially under irrigation. There is need for further investigation to determine the feasibility of this project.

190. *Engineering plan and feasibility.*—This is cut-over or brush land and can be cheaply cleared and made ready for cultivation but will require the use of fertilizers and humus. It will also, on account of being level valley plain land, lend itself to the use of large farm machinery. The irrigation of the tract may be feasible either by gravity or pumping, using the Souhegan River and nearby brooks as a source of water supply. There is, however, much water power developed in the former, and Pennichuck Brook is used for the Nashua water supply, so that there might be conflicting interests to satisfy. The precipitation is usually ample for ordinary soils, averaging about 39 inches per year, which is quite evenly distributed throughout the 12 months of the year.

191. *Transportation facilities and towns.*—Transportation facilities are particularly good. The main line of the Boston & Maine Railroad runs in the Merrimac Valley reaching from Boston to the White Mountains and Canadian points. Nashua, with a population of 30,000 or more, is the most important railroad center in the State, having branch lines extending in different directions, one of which extends the whole length of the valley under consideration. There are many and good highways. Manchester, with a population of over 80,000, is only about 15 miles from the tract. Boston and other large cities are not far distant; and the markets for all agricultural products are excellent.

NEW JERSEY.

GENERAL STATEMENT.

192. *Scope and result of investigations.*—New Jersey contains a large acreage of cut-over lands and many fresh-water swamps, as well as large areas of tidal marsh lands, some 30,000 acres of the latter having been embanked and at present at least partly cultivated. A large part of the unembanked tidal lands have been ditched in carrying out the mosquito-extermination campaign, and it is expected that within a few years the tidal marshes will be entirely ditched and the salt-marsh mosquito practically exterminated. It is possible that at a later time it may be economically feasible to embank these ditched lands and provide sluice gates and reclaim the lands for agriculture. Aside from the Great Piece Meadow it is not thought that the time has yet arrived for undertaking the reclamation of the fresh-water swamps, except as incidentally where such swamps may occur in larger areas of cut-over lands to be reclaimed. Furthermore, it is probable that many of these swamps will be utilized for raising cranberries. There are many large tracts of cut-over lands in the

State, some of which are probably suitable for settlement. The principal of these tracts are the Wharton tract (including the Frazier tract), containing 100,000 acres in Atlanta, Burlington, and Camden Counties; and the Stokes tract of 32,000 acres in Burlington County. The Wharton tract is described in the following pages as a representative type.

193. *Offers and prices of land.*—Although no offers of lands in New Jersey have been made directly, it is understood that a number of large tracts can be purchased at reasonable figures. The prices of lands here given are the taxable values on land alone. The range for north New Jersey is from $6.57 to $87.34. For south New Jersey, which comprises about three-fifths of the State, the prices run from $3.25 to $93.71 per acre.

194. *Soils and agricultural possibilities.*—The greater part of New Jersey has soils of the loam class, which are of glacial, lacustrine and alluvial origin. The Atlantic coast section of the State has soils varying greatly in texture and in the materials from which they are derived. The southern portion of the State lies in the coastal plain soil province. The upland soils are derived from unconsolidated ancient marine deposits and are largely sands and sandy loams. This section of the State and eastern New Jersey are ideal for truck crops, as well as for peaches, while the northern part of the State is particularly fitted for general agriculture and the growing of apples and peaches. Dairying is also largely followed and the section is well fitted for sheep. Both sweet and white potatoes are raised extensively.

LANDS NEEDING DRAINAGE.

GREAT PIECE MEADOW PROJECT.

195. *Location and acreage.*—The Great Piece Meadow, Hatfield Swamp, and other large swamps lie in the Passaic River Valley in Essex and Morris Counties. Above Little Falls there are about 30,000 acres of the swamp overflow bottom lands too wet for cultivation.

196. *Soils and agricultural possibilities.*—This valley was occupied during glacial times by Lake Passaic and the soils are mixed glacial deposits, and since those times the lands are overflowed by the Passaic River. They are fertile and at present grow large hay crops and afford pasture. If reclaimed, they would become valuable lands for trucking and specialized crops as well as general farming.

197. *Engineering plan and feasibility.*—There are complete hydraulic and engineering data available for this project, as it has been under consideration for many years. The plan of reclamation proposed for gricultural development consists in lowering the present dam at Little Falls some 20 inches and the removing of the bar at Two Bridges and the reefs between Little Falls and Two Bridges and the improvement of the rest of the channel by removing fallen trees, small bars, etc. Then, by ditching and improving the old ditches the land would be reclaimed. The acreage cost of such reclamation should not be excessive.

198. *Transportation facilities and towns.*—The various branches of the Delaware, Lackawanna & Western and Erie railroads surround

the area under discussion. Little Falls, Lincoln Park, Montville, and Essex Falls are all nearby railroad points, giving access to the New Jersey suburban section, as well as the markets of New York, Jersey City, etc., all of which are but a few miles distant.

CUT-OVER LANDS.

WHARTON PROJECT.

199. *Location and area.*—This tract contains 100,000 acres and lies in Atlantic, Burlington, and Camden Counties and its purchase by the State has been considered for some years.

200. *Soils and agricultural possibilities.*—Possibly one-fourth of the area is swamp land, the rest being cut-over pine and oak lands and scrub lands. The soils for the most part are sandy loams, underlain by sandy or gravelly subsoils. These are good farming lands and particularly adapted to early truck crops, fruit, poultry, and dairying.

201. *Engineering plan and feasibility.*—These are timbered and cut-over lands and would require the ordinary treatment to fit them for agriculture. They are particularly feasible from a settlement standpoint as the ownership is not diverse, as in most of the other large projects in New Jersey.

202. *Transportation facilities and towns.*—The tract is served by the West Jersey & Sea Shore, the Atlantic City Railroad, and Central Railroad of New Jersey. The towns are Ellwood, Hammonton, Rosedale, Waterford Works, Chesilhurst, Elm, and Atsion. Lying about midway between Atlantic City and Camden and Philadelphia, its markets are extensive.

TABLE 26.—*Lands needing drainage in New Jersey.*

Projects.	County.	Acreage.
Great Piece Meadows	Essex-Morris	30,000
Other areas	Various	347,000
Estimated total in State		377,000

TABLE 27.—*Agricultural cut-over lands in New Jersey.*

Projects.	County.	Acreage.	Estimated acreage available for community settlement.
Stokes	Burlington	32,000	15,000
Wharton	Atlantic, Burlington, Camden.	160,000	60,000
Total		132,000	75,000
Other areas	Various	468,000	
Estimated total in State		600,000	

NEW YORK.

GENERAL STATEMENT.

203. *Scope and results of investigations.*—Although there are undeveloped cut-over timber areas in New York, it is now considered that such tracts are better suited for reforestation than agriculture inasmuch as they are in the more mountainous parts of the State. For this reason only some of the larger swamps were investigated. Description of these swamp areas follow, under the captions of Genesee, Montezuma, Cicero, Wallkill, Fish Creek, and Hudson projects.

204. *Offers and prices of lands.*—Five tracts of land of 1,000 acres or larger have been offered for sale for settlement, or suggested as for sale. The designations of these tracts, some of which will be described later, are: Hudson project in Greene County; Flint Creek drainage district, Potter Center; Florence Leggett tract on the Hudson River; Oak Orchard Swamp (Genesee project), Genesee County; and the Berne section. Prices probably range from $5 to $75 per acre, depending on the quality of the soil, location, and extent of improvement.

205. *Soils and agricultural possibilities.*—The swamps examined all lie in the Erie-Ontario glacial plain and consist of muck of varying depths. The drowned lands of the Wallkill Valley have a peat soil, while the Hudson tract consists of good general farming soils but needs some drainage. The muck swamps are especially adapted to truck and special crops, as well as to hay and other forage crops. There is plentiful rainfall and the climate, though fairly severe during the winter, is splendidly suited to successful agriculture.

LANDS NEEDING DRAINAGE.

GENESEE PROJECT.

206. *Location and acreage.*—This project comprises the Oak Orchard Swamp of some 27,000 acres, the eastern or upper end of which, of some 8,000 acres of muck and 3,000 acres of upland, having been offered for sale to the Government. The swamp lies in Genesee and Orleans Counties, being some 20 miles in length.

207. *Soils and agricultural possibilities.*—The soil is a rich, black muck, varying in thickness from 2 to 10 feet with a clay and sand subsoil. Some 800 acres of the muck have been in cultivation for 10 years or more as well as all of the higher lands mentioned above. Onions, carrots, potatoes, lettuce, and celery have been most successfully raised, as well as hay and forage crops. The lighter lands are adapted to general farming.

208. *Engineering plan and feasibility.*—The swamp is mostly overgrown with brush and small timber, except for some open marsh lands and the lands now under cultivation. A company has ditched the upper end of Oak Orchard Creek and dug many lateral ditches, so that this part of the swamp (about 8,000 acres) only needs more laterals to be completely drained. There is much less fall in the western end of the swamp, and the reclamation of this part will be more expensive. The whole project seemingly offers a good opportunity for a community-soldier settlement.

209. *Transportation facilities and towns.*—Albion is some 8 miles north of the eastern portion of the swamp, while Batavia is about the same distance south. These places are on different sections of the New York Central lines, which furnish excellent transportation facilities to all the large markets of the East. Buffalo is but 30 miles from Batavia. The branch line on which are located Elba and Oakfield parallels the swamp on the south about 3 miles distant. Elba is the post office for the present development.

MONTEZUMA PROJECT.

210. *Location and acreage.*—This muck marsh of 30,000 to 40,000 acres lies at the foot of Lake Cayuga in Cayuga, Seneca, and Wayne Counties, about 30 miles west of Syracuse.

211. *Soils and agricultural possibilities.*—The soil is peat of varying depths, little of which has yet been reclaimed and cultivated. Much wild hay is grown and cut at present and the flags are extensively used for cooperage and the manufacture of paper. There is little doubt that these peat and muck soils have as great agricultural possibilities as those of similar swamps in this section that have already been placed under cultivation.

212. *Engineering plan and feasibility.*—The swamps are surrounded by precipitous higher lands which divide the marsh into several main sections which are further divided by the old Erie Canal, the New York Barge Canal and its branches, and the Clyde and Seneca Rivers, as well as by the New York Central Railroad. The water table has already been lowered to a considerable extent in portions of the marsh by the completion of the barge canal and a little longer period will determine the natural draining effect of this improvement. It is possible that the middle western and northwestern portion of the marsh might readily be drained by an outlet to the north through Black Creek, Crusoe Lake, Butler Creek, and Wolcott Creek, thus avoiding any connection with an outlet into the barge canal or Seneca River. The lower portion (4,000 acres) of this section of the marsh has been examined and reported upon by the New York State Conservation Commission. The watershed of this improvement would be either 20 or 35 square miles, depending upon whether or not the drainage of the watershed of the western part of Black Creek were diverted to the southwest. It is questionable whether just at present it would be advisable to open up such a large body of specialized-crop, raw-muck land when no agricultural development has as yet been made. A thorough examination and some surveys would be needed before a decision can be reached.

213. *Transportation facilities and towns.*—Railroad transportation facilities are good for the area and, as a general thing, the country is particularly well supplied with roads and highways, many of which are highly improved. Savannah, on an island in the midst of the marsh, is the only town of fair size in the immediate vicinity of the marsh, but Auburn lies a little to the southeast, while Syracuse and Rochester are not far distant. Both the West Shore and New York Central lines cross the marsh in an easterly and westerly direction, passing through Savannah.

CICERO PROJECT.

214. *Location and acreage.*—The Cicero Swamp is in two portions, separated by about 2 miles of higher lands except where Mud Creek connects the two swamps. These lands lie from 2 to 8 miles distant from and south of the western end of Lake Oneida in Onondaga County. The western portion of the swamp contains about 2,500 acres and the eastern portion about 6,000 acres.

215. *Soils and agricultural possibilities.*—This is a peat and muck swamp varying in depth from 1 to 31 feet. It is of dark granular material to a depth of 4 feet, below which for 10 feet it is more fibrous and compact. At the bottom it forms a semifluid black muck. The muck is underlain with light-colored clays. A considerable area of the western portion of the eastern swamp body is now developed. At the extreme end of the swamp several hundred acres have been drained and cultivated. All of the usual truck crops, as well as hay and forage crops, are well adapted to these muck soils.

216. *Engineering plan and feasibility.*—The eastern and larger portion of the swamp may be easily drained. The western end of this portion naturally has an outlet into the upper end of Mud Creek, which traverses the smaller or western portion of the entire swamp. The extreme eastern end of the large swamp already has a drainage-ditch outlet extending to Bridgeport, where the water level of Oneida Lake is reached. A continuation of this ditch into the swamp would furnish a good outlet, or a main ditch could be dug through the heart of the swamp and to the north through the low-lying higher land connecting with a small creek which flows into Oneida Lake. The outlet for the 2,500-acre swamp is complicated by the Barge Canal water level. A plan for the reclamation of this part of the swamp was made by the New York State Conservation Commission. The swamps are largely covered with soft maple, elm, and brush. The expense of clearing and draining should be very reasonable and, on account of portions of the swamp already being under cultivation, this seems a project worthy of further investigations.

217. *Transportation facilities and towns.*—The bulk of this swamp lies only about 7 miles from the heart of the city of Syracuse, and the swamp is completely surrounded and, in parts, crossed by highways, the adjacent farming country being well settled. Manlius station, on the New York Central lines, lies about 3 miles south of the eastern end of Cicero Swamp. Liverpool is about 4 miles south and Woodward and Cigarville lie about 1 mile south and north, respectively, of the western end of the swamp. The Rome, Watertown & Ogdensburg Railroad passing through these points, crosses the swamp. Syracuse, furnishing a large market, lies practically at the swamp, and Rochester, Buffalo, Albany, and New York are not far distant.

WALLKILL PROJECT.

218. *Location and acreage.*—These lands are known as the Drowned Lands or Florida Marshes and have an area of some 25,000 acres. They lie in Orange County in the valley of the Wallkill River, and are more or less continuous with similar lands in New Jersey.

219. *Soils and agricultural possibilities.*—The soil consists of peat of depths varying from nothing to 18 feet. The lands are largely

owned by one man, which has doubtless prevented their development, as they are seemingly well adapted to nearly all crops except grain. Portions of the swamp have been cultivated, but by far the greater part of the swamp is used as pasture and hay lands.

220. *Engineering plan and feasibility.*—The reclamation of these swamps would probably require an improvement of the Wallkill River with submain and lateral ditches throughout the swamp. Few portions are covered by water, except occasionally, and the greater part of the swamp is forested with both deciduous and coniferous trees. The forest floor is dense with mosses and liverworts while burned-over areas are covered with a dense copse of birch and poplar. It would require a thorough field investigation to determine the feasibility and desirability of these swamp lands as a possible project.

221. *Transportation facilities and towns.*—The lands are traversed by the Erie Railroad and the W. W. S. & W. R. R. and extend as far north as New Hampton. Middletown and Goshen are two of the larger near-by towns, while the markets of Greater New York and vicinity are only about 50 miles distant.

FISH CREEK PROJECT.

222. *Location and acreage.*—These swamp lands are located along Fish Creek and around Hickory and Mud Lakes in western St. Lawrence County. They have an area of about 5,000 acres.

223. *Soils and agricultural possibilities.*—The soil is an especially fine quality of muck, suitable for the production of vegetables and forage crops.

224. *Engineering plan and feasibility.*—A detailed drainage plan was made for this project by the New York State Conservation Commission, their conclusion being that thorough drainage could be secured within reasonable limits of cost. The plan contemplates a single main ditch extending the whole length of the swamp, approximately following the line of the creek. The cost of the right of way in 1915 was estimated at $20 per acre, which will give some idea of the unimproved value of the land at that time. This is considered as a possible project.

225. *Transportation facilities and towns.*—A branch of the New York Central lines running north to the near-by cities of Morristown and Ogdensburg on the St. Lawrence River lies about 5 miles to the west of the swamp, the nearest stations being Hammond and Brier Hill. Watertown is some 440 miles to the south.

HUDSON PROJECT.

226. *Location and acreage.*—This tract of some 15,000 acres lies along the Hudson River in Greene County between Coxsackie and Athens.

227. *Soils and agricultural possibilities.*—The soils consist largely of a sandy loam and the topography varies from level to rolling. The lands are now under cultivation in rather large holdings. The range in price for these lands is probably from $20 to $75 per acre.

228. *Engineering plan and feasibility.*—Although uplands, they need some drainage outlets. This is, apparently, a favorable location for a soldier settlement.

229. *Transportation facilities and towns.*—The West Shore Railroad passes through this tract with stations at Coxsackie and West Athens. The tract is also well provided with roads including the "Old Kings Road." In close proximity to Albany, Hudson, and the mountain resorts, and with boat service on the Hudson River to New York, this tract is very favorably situated as to large markets.

TABLE 28.—*Lands needing drainage in New York.*

Projects.	County.	Acreage.
Genesee	Genesee and Orleans	27,000
Montezuma Marshes	Several	30,000
Cicero Swamp	Onondaga	8,500
Wallkill	Orange	25,000
Fish Creek	St. Lawrence	5,000
Hudson tract	Greene	15,000
Other areas	Various	589,500
Estimated total in State		700,000

NORTH DAKOTA.

GENERAL STATEMENT.

230. *Scope and results of investigations.*—Out of about 2,000,000 acres of land originally needing drainage in North Dakota, there still remain about 880,000 acres yet to be drained. By far the greater part of this area lies in the Red River and the Mouse River Valleys in old glacial lake beds. The remaining areas exist in small bodies in innumerable depressions and sloughs in the glacial area of the State. The Mouse River Valley contains about 25,000 acres that require drainage, and the Red River Valley about 750,000 acres. These are not lands of a swampy character but are subject to overflow from excessive precipitation. North Dakota is essentially a prairie State and there are, therefore, no cut-over lands within its borders. The investigations of the northern division were confined to the area east of the ninety-eighth meridian, the remaining part of the State lying in the western division. Owing to the fact that the lands needing drainage are subject only to occasional overflow they are occupied and cultivated and are not generally available for farm purposes. One area, however, that is a general exception to this rule, was found in the Bois de Sioux Valley connecting Lake Traverse with the Red River. This project contains lands in Minnesota, North Dakota, and South Dakota. It will later be discussed in detail in this report.

231. *Offers and prices of land.*—Two tracts of 1,000 acres or over were offered as suitable land for soldier settlement, and it is believed that no difficulty will exist in securing other offers, if desired. Undrained lands range from $10 to $50 or more per acre, depending on the location and the extent to which drainage is needed.

232. *Soils and agricultural possibilities.*—The soils of eastern North Dakota belong either to the glacial and loessial province or to the glacial lake and river terrace province, both of which contain some of the richest soils in the United States. In the eastern part of the State, in the Red River Valley, where most of the undrained lands lie, there is sufficient precipitation usually to produce good

crops. The kinds of crops that can readily and profitably be grown in this region are small grains, silage corn, grasses, potatoes and other vegetables.

LANDS NEEDING DRAINAGE.

BOIS DE SIOUX.

233. *Location and acreage.*—The Bois de Sioux project is located in Richland County, N. Dak.; Wilkin and Traverse Counties, Minn.; and Roberts County, S. Dak., along Lake Traverse and the Bois de Sioux River. It is estimated that there are approximately 50,000 acres in this project, 20,000 acres of which lie in North Dakota, 25,000 acres in Minnesota, and 10,000 acres in South Dakota.

234. *Soils and agricultural possibilities.*—The surface soil of the lands within this project is a rich silt loam and the subsoil is a clay loam. The agricultural possibilities are similar to those of the well-known Red River Valley. These lands have the climatic advantage, however, of being in the extreme southern part of this valley.

235. *Engineering plan and feasibility.*—The problem in this project is to prevent overflow of the waters from Lake Traverse onto the lands along Lake Traverse and the Bois de Sioux River. The best means of accomplishing this is to divert Lake Traverse into Minnesota River drainage basin and to provide compensating storage in Big Stone Lake and possibly also in Lac qui Parle. Supplemental provision for drainage of the Bois de Sioux River Valley will, of course, be necessary. If it is found impracticable to divert Lake Traverse into Big Stone Lake, it will be possible to store the entire flood waters of its drainage basin in the lake and gradually to discharge these waters down the Bois de Sioux River channel into Red River. The overflow conditions from Lake Traverse in North Dakota are now the subject of a suit against the State of Minnesota, on the grounds of claimed increase floods in Lake Traverse due to drainage of lands tributary to the lake.

236. *Transportation facilities and towns.*—Good transportation facilities are available, as the region is traversed by the Sault Ste. Marie Railroad, the Chicago, Milwaukee & St. Paul Railroad, and the Great Northern Railroad. The principal towns are Wahpeton, Taylor, and Fairmount, N. Dak.; and Breckenridge, Childs, and Whiterock, Minn. Distant markets will be found in Minneapolis and St. Paul.

TABLE 29.—*Lands needing drainage in North Dakota.*

Projects.	County.	Acreage.
Bois de Sioux	Richland	20,000
Other areas	Various	860,000
Estimated total in State		880,000

OHIO.

GENERAL STATEMENT.

237. *Scope and results of investigations.*—After inspection of existing data on drainage in Ohio and conference with State officials, the field investigations in this State were confined to localities most

likely to yield results. These areas are largely concentrated in the white clay region of southwestern Ohio in the upland region between the Ohio River and Great Lakes drainage basin and in the Lake Erie shore swamps. The white clay lands can be best drained by the farmers themselves, as the problem is one of tiling rather than open-ditch construction of magnitude. Along the shores of Lake Erie, mainly between Toledo and Sandusky, there are about 20,000 acres of swamp lands that can be drained by diking and pumping. These lands have soils adapted to growing onions, celery, and other vegetables. On the divide there are numerous small swamps, some of which can be economically reclaimed. The largest of these is probably the Kilbuck Swamp, in Kilbuck Valley, in Holmes County, and it contains only about 4,500 acres. There is also a considerable acreage in various river valleys in the State that are subject to overflow, some of which are being reclaimed by the conservancy districts. The total estimated swamp and overflow lands in the State is 200,000 acres. There are also opportunities for colonies on large holdings now farmed by tenants.

TABLE 30.—*Lands needing drainage in Ohio.*

Projects.	County.	Acreage.
Lake Erie	Lucas-Ottawa	20,000
Kilbuck Swamp	Holmes	4,500
Other areas	Various	175,500
Estimated total in State		200,000

OREGON.

GENERAL STATEMENT.

238. *Scope and results of investigations.*—The report on the cut-over lands in Oregon is based on a personal knowledge of the investigator, gained previous to this investigation, and on the data furnished by the head of the development bureau of the Portland Chamber of Commerce in cooperation with the United States Forest Service, at Portland; also upon a report prepared several years ago as a result of a joint economic survey conducted by the State administration, the State university and agricultural college, and the Portland Chamber of Commerce. No detailed field examinations were made under the present appropriation, other than to visit general points of information. The data for each county were primarily furnished by the county assessors, but the above-mentioned bureau and Forest Service, in the light of their personal knowledge, combined these data with previously existing data, the results of which are given in Table 31, page 166. It is thought that there are approximately 830,000 acres of cut-over land within the State suitable for agriculture; the bulk of this area lies west of the Cascade Range. To better describe these lands as to location, topography, transportation, etc., but chiefly for geographic reasons, they have been grouped into 10 districts. These districts are as follows: Blue Mountain, Columbia River, Coos, East Willamette; Grants Pass, Hood River, Roseburg, Tillamook, Wasco, and West Willamette.

239. *Offers and prices of land.*—No offers of land were solicited in Oregon and only one tract of 3,000 acres was offered, this land being already mostly under cultivation. Little or no farming land is changing hands, and favorably-situated cut-over land is often priced high. The average price for it, when there is a market for it in small tracts, is about $40 per acre, and in large tracts about $10. Improved farm land ranges from $100 to $400 or $500 per acre, while the average price for improved farms in the logged-off districts is, in all probability, about $150 per acre.

240. *Soils and agricultural possibilities.*—The soils are derived from igneous, metamorphic, and sedimentary rocks or from an admixture of various rocks, and are mainly residual or alluvial in character. Some of the soils are, however, derived from glacial action. Generally the soils are quite productive and the agricultural possibilities are usually good both for general farming and for fruit growing.

241. *Engineering plan and feasibility.*—The size and species of trees which occupied many of these cut-over lands generally make the problem of land clearing an expensive proposition. Still hundreds of thousands of acres of similar lands have been privately cleared and put under cultivation. The lands adapted to fruit growing, especially in renowned fruit-growing sections, are valuable when cleared and a profitable holding and need consist of but few acres. Under present conditions and at current prices for material and labor land clearing in the more heavily wooded sections is practically prohibitive, estimated on the basis of commercial values. Under normal conditions and use of improved methods and machinery the less-difficult areas can be economically cleared. Lands adapted particularly to dairying and stock raising can be gotten into pasture and cleared later when conditions are favorable. The reclaimable cut-over lands suitable for agriculture, included here, consist not only of heavily-stumped lands, but of lands where the timber was small and light as well as burned-over districts and brush-covered areas. It is probable that the larger part of these lands is held in large tracts by various lumber companies, but no data have been secured along this line.

242. *Transportation facilities and towns.*—Space does not permit of taking this matter in detail for all the districts described, but it may generally be stated that all the districts are reached or traversed by railroads and that the highways, both paved and macadamized, as well as the ordinary county roads, are far more numerous than would be expected in regions of such large, sparsely populated areas. Each district has its own thriving community towns and some include the metropolitan districts of the State. Transportation is good. Markets for all sorts of farm produce in Oregon is now, and has practically been from the early days of settlement, good and remunerative and it is expected to remain so as the population is constantly increasing, particularly the industrial and urban population.

CUT-OVER PROJECTS.

243. *Location and acreage.*—Ten principal districts, already mentioned above, are summarized in Table 31, together with the estimated acreage of cut-over lands in each, as well as the counties or

parts of counties embraced. The total acreage of cut-over lands suitable for agriculture as there shown has been estimated to be 830,000 acres.

244. *Soils and agricultural possibilities.*—Taking the districts in the order named, the following brief descriptions will give some idea of the conditions and the agricultural possibilities.

245. *Blue Mountain district.*—This district is in the extreme northeastern part of the State and is located along the crest of the Blue Mountain Plateau, embracing some 1,225 square miles and ranging in elevation from 3,000 to 4,800 feet. Its elevation is too high for growing anything but the hardier grains, vegetables, and forage crops. Wheat, oats, barley, as well as vegetables, are largely grown. It is a good dairy country, but stock must be housed during the winter. The precipitation ranges from 30 to 45 inches and the snowfall from 2 to 4 feet, although it does not lie for any length of time. The surrounding country is highly developed as a wheat-producing region, although considerably lower in altitude.

246. *Columbia River district.*—This is mostly a rolling, forest-covered, hill country, the soils being mostly of a clay loam, dark brown or reddish in color, known as "red-shot" soils, with a liberal capping of mold of considerable depth and rich in quality. Precipitation ranges from 40 to 60 inches, with a four to six weeks' dry spell during midsummer. All kinds of farm products yield well, as do all sorts of deciduous fruits and berries. The markets are excellent.

247. *Coos district.*—This district is practically a continuation of the Tillamook district, which will be described later. Its area is 3,300 square miles. While somewhat rough and mountainous, a fair percentage of the area is comparatively level. The climate is moderate and uniform, farming operations being seldom interrupted by either frost or snow. On the lowlands the soil is usually a sedimentary deposit of alluvium and humus mixed more or less with sands. The hill-land soil is very generally a sandy loam of dark-reddish color and both deep and rich. Dairying is an especially attractive industry, but fruit raising and forage and general crops all do well. The precipitation ranges from 65 to 75 inches per year.

248. *Grants Pass district.*—This district practically coincides with the drainage basin of the Rogue River, including over 6,000 square miles. It is inclosed by high mountains. The stream valleys, though less in number than in the Roseburg district, on the north are much larger and the intervening ridges much higher and more sharply defined. The western part is exceedingly rough and mountainous, and the Rogue River is in a deep, narrow, tortuous gorge, contrasting with the broad sweep of valley land above. This constitutes the southern terminus of Douglas fir. Cedar, spruce, hemlock, oak, madrona, myrtle, and ash attain considerable size in the mountainous sections. The climate of the upper part of the district is moderate and especially adapted to fruit growing. Practically everything that can be grown elsewhere in Oregon can be grown equally well in Rogue River Valley. The soils are derived from basic igneous rocks generally.

249. *Hood River and Wasco districts.*—These districts lie along the north and east flanks, respectively, of Mount Hood. The areas of

the districts are 612 and 470 square miles. The Hood River district embraces the drainage basin of Hood River, the entire valley having a sharp decline corresponding with the inclination of the mountain side. The tillable cut-over land when reclaimed for cultivation brings large prices per acre. The climate varies with the altitude, which ranges from 500 to 2,700 feet, the limit of the agricultural zone. The precipitation ranges from 20 to 70 inches, also depending upon altitude as well as location. The soils are clay loams and are fertile. This is an exceptional fruit-growing section. The Wasco district embraces largely the drainage area of the White River and ranges in altitude from 600 to 2,500 feet. The soils and climate are similar to the Hood River district. Fruit is one of the principal products and is of high grade. All sorts of grain and other farm products yield well.

250. *Roseburg district.*—This district comprises exclusively the valley and drainage basin of the Umpqua River, with an area of 4,500 square miles. It is a rolling, hilly country, interspersed with numerous valleys and surrounded by high, rugged mountains. It is so protected from the prevailing trade winds of the Pacific coast that there is a manifest modification of its climatic conditions both as to temperature and precipitation, the climate being mild and exceptionally uniform. The growing season is long and frost on the lower levels is negligible. Precipitation varies from 20 to 50 inches. Irrigation is necessary for fruit raising in lower sections. The soils are very diversified, due to their origin from metamorphic rocks, limestone, marble, sandstone, shales, granite, and basalt, and range from the rich alluvial soils of the valleys, which are now mostly under cultivation, to the shallow, gravelly soils of the bench lands. Farm produce of great variety and good quality and, especially fruits of national reputation, distinguish the Umpqua basin.

251. *Tillamook district.*—This is the northern part of a narrow strip of land along the coast. It is 125 miles long and does not exceed 35 miles in width to the crest of the Coast Range on the east. Numerous and irregular spurs extend out from the main ridge, and many of them reach and terminate at the shore line in bold rocky escarpments. Notwithstanding the apparently rough and broken character of the country there is a considerable portion of it of such contour and declivity as to permit of its utilization and cultivation. This coast region is especially adapted to dairying, chiefly on account of the fact that the winters are so mild that stock can graze throughout the year. Ordinary farm produce can also be grown. The precipitation is very heavy, the average annual maximum being 100 inches, but it is mostly a fine, misty, or gentle precipitation, causing practically no erosion. The soils of the valleys are sedimentary alluvials and sandy loams, and on the uplands are residuals from a predominating formation of basalt.

252. *Willamette districts.*—The east Willamette district includes the forested foothills and western slopes of the Cascade Mountains for almost the entire length of the valley, a distance of about 100 miles. The west Willamette district includes the eastern slope of the Coast Range and the foothills bordering on the Willamette Valley basin on the west. This is a large intermountain basin some 40 to 50 miles in width. The floor of the valley is a comparatively level plain, broken at several places by groups and ridges of low hills.

The soil of the valley floor proper is an infertile sedimentary silt, having been at one time the bottom of an inland sea or estuary. Around the rim of the valley the soil improves as it merges into the foothills and quickly attains a high degree of fertility in ascending from the valley level. The climate, the rainfall, and the soil are all favorable to good yields and are adapted to intensive farming, fruit growing, and stock raising. The climate is moderate and the annual precipitation is 45 to 60 inches.

TABLE 31.—*Agricultural cut-over lands in Oregon.*

Project.	County.	Acreage suitable for agriculture.	Estimated acreage available for community settlement.
Columbia River	Columbia, Washington, Yamhill, Marion, Clackamas, and Multnomah.	220,000	110,000
Blue Mountain	Umatilla and Union	20,000	10,000
Coos	Coos, Lane, Douglas, and Curry	175,000	75,000
East Willamette	Marion, Linn, and Lane	30,000	15,000
Grants Pass	Jackson, Josephine, and Curry	28,000	10,000
Hood River	Hood River and Wasco	10,000	.....
Roseburg	Douglas	200,000	100,000
Tillamook	Clatsop, Tillamook, and Lincoln	100,000	50,000
Wasco	Wasco	3,000	.....
West Willamette	Benton, Yamhill, Polk, and Lane	34,000	15,000
Total	.....	820,000	385,000
Other areas	Various	10,000	.....
Estimated total in State	.....	830,000	.....

TABLE 32.—*Classified acreages of unoccupied cut-over lands in various counties in cut-over regions of Oregon.*

County.	Area of unoccupied cut-over lands.	Area most suitable for agriculture.	Area most suitable for grazing.	Prevailing price of cut-over lands.
	Acres.	*Acres.*	*Acres.*	
Baker	81,400	.....	81,400	.....
Benton	4,600	1,400	3,200	$7.50
Clackamas	100,000	10,000	60,000	$25.00–40.00
Clatsop	123,500	61,800	30,000	25.00–40.00
Columbia	200,000	70,000	100,000	25.00–40.00
Coos	263,000	100,000	110,000	25.00–40.00
Crook	3,000	.....	3,000	8.00–10.00
Curry	91,000	10,000	40,000	10.00
Douglas	470,000	240,000	115,000	10.00–30.00
Deschutes	20,300	.....	20,300	.....
Grant	9,000	1,000	8,000	.....
Harney	3,000	.....	3,000	.....
Hood River	30,000	8,000	18,000	25.00–100.00
Jackson	32,000	10,000	22,000	5.00
Jefferson	3,000	500	2,500	.....
Josephine	52,000	10,000	35,000	10.00
Klamath	40,000	4,500	30,000	.....
Lake	3,000	.....	3,000	.....
Lane	200,000	50,000	140,000	15.00–25.00
Lincoln	75,000	25,000	50,000	10.00–30.00
Linn	50,000	10,000	20,000	40.00–60.00
Marion	15,000	2,500	11,500	30.00–60.00
Multnomah	90,200	41,000	40,000	.....
Polk	34,000	10,000	20,000	.....
Tillamook	110,000	20,000	80,000	25.00–60.00
Umatilla	100,000	.....	80,000	.....
Union	150,000	20,000	100,000	.....
Wallowa	40,000	10,000	20,000	.....
Wasco	25,000	5,000	15,000	.....
Washington	150,000	75,000	75,000	.....
Yamhill	100,000	35,000	50,000	10.00–30.00
Total	2,668,000	830,700	1,385,900	.....

PENNSYLVANIA.

GENERAL STATEMENT.

253. *Scope and results of investigations.*—Lack of time and funds prevented complete investigations in Pennsylvania. The Dubois tract in Clearfield County has, however, been suggested as suitable for a project, but there has as yet been no opportunity to examine it. There are no swamps to be reclaimed in the State, and the overflow lands are unimportant from the standpoint of soldier settlement. The cut-over lands in the State are for the most part in the rougher mountainous sections of the State, which are not adapted to general agriculture.

254. *Offers and prices of lands.*—The Dubois tract just mentioned is the only offer of land and no price was volunteered. The United States Bureau of Soils states:

> Land values vary greatly, owing to the presence of coal, from $20 to $200 an acre, with a general farming value of $25 to $40.

255. *Soils and agricultural possibilities.*—The soils are all of glacial or fluvatile origin and are extremely varied. The valley lands best suited to agriculture are practically all in cultivation, the Cumberland Valley down into Maryland being a very rich farming section. Aside from general farm crops, there is a very large market for all the truck crops that can be raised not only in the State, due to its large mining and manufacturing populations, but also on account of proximity to Philadelphia and the other large Atlantic coast cities.

CUT-OVER LANDS.

DUBOIS PROJECT.

256. *Location and acerage.*—There are about 10,000 acres in this tract, or rather several tracts, as there are a number of owners involved. These lands lie two-thirds in Winslow Township, Jefferson County, and one-third in Brady Township, Clearfield County.

257. *Soils and agricultural possibilities.*—All of the soils have been derived principally from conglomerate sandstones and shales and are probably silt loam and shale loam. These soils are here ordinarily deficient in organic matter and lime. Some good farming land exists. The topography is steeply rolling to hilly, the hills being rounded and not rugged. The soils are well drained, except for seepage at the base of some of the hills. Erosion is active. Orcharding, stock-raising, and market gardening are probably better adapted to the conditions than general farming.

258. *Engineering plan and feasibility.*—It is thought that these are cut-over and abandoned coal mining lands but data have not been obtained. A very careful investigation will be necessary to determine the feasibility and possibilities of the project owing to difficulties often arising from large mining operation beneath and in the vicinity of the land. The hilly topography may introduce difficulties in the way of effecting an economical use of some of the land.

259. *Transportation facilities and towns.*—The immediate tract has at its borders Falls Creek, Dubois, Reynoldsville, and Sykesville,

all of which are interconnected with branches of the Pennsylvania lines. Johnstown on the main line is some 50 miles south of Dubois. The local markets, mostly mining districts, are probably ample to take care of the production. State highways connect Reynoldsville and Dubois and Sykesville and Dubois. The former is improved throughout its course in Jefferson County, and improved roads become a necessity in the spring and fall seasons.

TABLE 33.—*Agricultural cut-over lands in Pennsylvania.*

Project.	County.	Acreage suitable for agriculture.	Estimated acreage available for community settlement.
Dubois	Clearfield and Jefferson	10,000	10,000
Other areas	Various		

RHODE ISLAND.

GENERAL STATEMENT.

260. *Scope and result of investigations.*—The larger swamps of Rhode Island occur in Washington County, in the southern part of the State. They are largely caused by, and their drainage prevented by, the several developed water powers along the Pawcatuck River. As their reclamation, except by leveling and pumping, would necessitate the removal of the dams, it is considered that their development is not now desirable. The State is divided into the Narragansett Bay area of plains and low-lying rounded hills and the western broken, hilly section, which is a remnant of an old Appalachian formation. Two, and possibly three, tracts were tentatively located, which seem worthy of further investigation. They are all in the Narragansett Bay area, which is is the best agricultural section of the State, and are classed as cut-over or scrub or sprout areas.

261. *Offers and prices of lands.*—No offers of land from Rhode Island have been received. The average value of unimproved lands, but including such buildings as still happen to be on them, is about $9 per acre. Much rough land in the western part of the State can probably be bought for $3 per acre.

262. *Soils and agricultural possibilities.*—The agricultural soils of the eastern and southern parts of the State have sandy and loamy soils which, although agriculture has been continually decreasing during the past century, are yet fertile. The principal cause of farm abandonment in this section has been the increase of manufacture to the detriment of agriculture. There are splendid opportunities for a renewal of agriculture in this State, especially along lines of market gardening, as the local markets, especially Providence, are large. Furthermore, a farmers' exchange has been established that owns its own motor trucks for the collection of produce. This exchange, in which many in the State are deeply interested, bids fair to build up a much healthier state of agriculture in the near future.

CUT-OVER LANDS.

KINGSTON PLAINS PROJECT.

263. *Location and acreage.*—There are two tracts of about 1,000 acres each, one of which has in times past been all under cultivation but is now only partially so, and the other consisting of scrub and sprout land without any buildings. These tracts lie immediately east and south of West Kingston in Washington County about 30 miles from Providence. Within a 3-mile circle, with West Kingston as a center, and mostly in the northwest quadrant, are probably at least 3,000 acres more of waste or vacated land which might be procured, making some 5,000 acres in all quite closely connected.

264. *Soils and agricultural possibilities.*—The soils of this project are sandy loam, silt loam, and stony loam. The sandy loam is free from stones and large gravel, is warm, early, and easily tilled. The surface is level and unbroken. This soil is particularly well adapted to truck and garden products. The silt loam is practically free from stones and gravel and is friable and mellow; the surface is level and unbroken. This soil is suitable for growing diversified crops. The stony loam is mainly firm, compact loam with considerable quantities of bowlders and gravel intermixed. It retains moisture well, requires little drainage, and suffers little from erosion.

265. *Engineering plan and feasibility.*—These lands are cut-over scrub and sprout lands, which by the use of proper machinery may be cleared on an extensive scale at a comparatively low cost. That portion of the Great Swamp lying north of Wordens Pond and forming a portion of the undeveloped 1,000-acre tract mentioned above could probably be cheaply leveed and a pumping drainage system installed. Combined with the established farms which are interspersed with these various tracts and vacant farms, it would doubtless be feasible and desirable to establish a community. A large part of the modern conveniences are already established in this section, such as good roads, telephones, electric light and power lines, rural mail routes, churches, schools, agricultural colleges, railroads, etc. The project is recommended for further investigation.

266. *Transportation facilities and towns.*—The Shore Line of the New York, New Haven & Hartford Railroad between Providence and New York passes through the Kingston plains, West Kingston being about the center of the proposed project. Usquepaugh, 3 miles to the northwest, is a small inland town, while Kingston, where is located the State Agricultural College, lies 2 miles east. Fifteen miles northeast on the railroad is East Greenwich, while Providence, with a population of over 300,000, is only about 30 miles distant, furnishing an excellent local market for all agricultural products. Improved State highways make motor-truck transportation entirely feasible.

WARWICK DOWNS PROJECT.

267. *Location and acreage.*—The Warwick Downs in the northeastern corner of Kent County lie from 5 to 8 miles south of the Union Station in Providence. There are about 5,000 acres in a compact body lying practically entirely unused.

268. *Soils and agricultural possibilities.*—The soil is nearly all a mellow, brown, sandy loam to an average depth of 10 inches, usually containing some fine gravel. The soil is free from stones and large gravel, and is warm, early, and easily tilled. The subsoil to depths of greater than 3 feet consists usually of a few inches of loose sandy loam of yellow color, quickly grading into coarse, loose sand and fine gravel. The surface is level and unbroken. Drainage is thorough and adequate, and the land rarely suffers from drouth, due to the proximity of the water table. Grass, grain, and other general farming products, and particularly trucking and market gardening, are the crops eminently suited to this soil.

269. *Engineering plan and feasibility.*—This tract is largely scrub, sprout, and pasture land at present, and presents slight obstacles to easy clearing and preparation for the plow. By use of a heavy tractor and large plows a large part of the small growth could probably be turned under. This vegetation would soon rot and add humus to the soil. On account of its closeness to Providence, and being surrounded by suburban and summer transient property, the land values here would undoubtedly be higher than on the Kingston Plains project, but market gardening would doubtless be the chief type of farming and the farms would naturally be quite small.

270. *Transportation facilities and towns.*—The shore line of the New York, New Haven & Hudson River Railroad, with stations at Appanaug, Greenwood, and Hills Grove, is just west of the tract, and there is electric line service as well. The tract is surrounded by improved highways and all other modern conveniences and would furnish an ideal tract for a community center. Providence would furnish an ample market for all products.

WOOD RIVER JUNCTION PROJECT.

271. *Location and acreage.*—In southeast Washington County surrounding Wood River Junction is a tract of several thousand acres which might be suitable for a community center. These lands were not personally examined.

272. *Soils and agricultural possibilities.*—There is a large body of sandy loam in this locality principally north of the junction. A large body of sand lies just to the west which is probably not of much agricultural value. The former is preeminently a trucking soil so that the agricultural possibilities in this section should be excellent.

273. *Engineering plan and feasibility.*—Although this tract was not visited, it is believed that the physical conditions here are similar to those on the Warwick Downs project except that the land here is undoubtedly held at a much lower price on account of location.

274. *Transportation facilities and towns.*—Wood River Junction is also on the shore line 10 miles southwest of West Kingston. The Wood River branch runs north through the tract about 6 miles to Hope Valley. The same markets would be available as for the other projects described.

TABLE 34.—*Agricultural cut-over lands in Rhode Island.*

Project.	County.	Acreage suitable for agriculture.	Estimated acreage available for community settlement.
Kingston Plains	Washington	5,000	5,000
Warwick Downs	Kent	5,000	5,000
Wood River Junction	Washington	5,000	5,000
Total		15,000	15,000
Other areas		170,000	
Estimated total in State		185,000	

SOUTH DAKOTA.

GENERAL STATEMENT.

275. *Scope and results of investigations.*—The investigations conducted by the northern division in South Dakota were confined to the area east of the ninety-eighth meridian, except the James River Valley, which is cut by that meridian. There were originally about 5,000,000 acres of swamp and overflow lands in the State. This acreage, generally speaking, was scattered throughout the area in small tracts easily drained, if susceptible of economical drainage at all. Up to 1918 the State engineer reports about 600,000 acres of the total as drained, and there is at present a 100,000-acre project under construction in Marshall County. There are about 190,000 acres of excellent occupied and cultivated lands in the James River Valley subject to overflow. These lands are located in a former old lake bed and are flat and hard to drain. In the valley of Lake Traverse and of the Bois de Sioux River there are about 10,000 acres that are considered feasible both as to reclamation and as to settlement. This project lies also partly in Minnesota and North Dakota. South Dakota is essentially a prairie State and consequently there are no cut-over lands in it.

TABLE 35.—*Lands needing drainage in South Dakota.*

Project.	County.	Acreage.
Bois de Sioux	Roberts	10,000
Other areas	Various	4,190,000
Estimated total in State		4,200,000

VERMONT.

GENERAL STATEMENT.

276. *Investigations.*—It was not possible to conduct field investigations in Vermont in the limited time. For the most part the State is hilly to mountainous, but in spite of that fact agriculture has flourished in times past. Large crops of grains and hay and forage crops were raised and sheep raising was carried on very extensively.

Dairying is still a most important industry, fruit raising is extensively engaged in, and the State stands at the top in the production of maple sirup. Otter Creek Valley in Addison and Rutland Counties is nearly level to slightly rolling for a strip of about 20,000 acres, and there are two large swamps in this section. In Addison County just east of Lake Champlain, including the Dead Creek Valley, is an area of a number of square miles of level to rolling land. In Grand Isle County there is quite a tract of slightly rolling and swampy land, while in Franklin County there is a similar tract of about 15,000 to 20,000 acres. In this same county at the mouth of the Missisquai River is a swamp of about 7,500 acres, a large part of which it may be possible to reclaim by diking and pumping. The level lands in Addison County all have a heavy clay or clay loam soil varying in depth from 6 to 12 inches, with a subsoil of heavy clay somewhat tenacious when wet, but extremely stiff, compact, and intractable when dry. This soil is excellent for hay, and oats and barley yield well. The railroad transportation facilities as well as the highways are good and, owing to the present general languishing state of agriculture in New England and to the great near-by populations, the markets are sure and large for all possible agricultural products.

WASHINGTON.

GENERAL STATEMENT.

277. *Scope and results of investigations.*—Investigations by the northern division in this State cover only cut-over lands. The lands needing drainage and those needing irrigation were investigated by the western division. The larger part of all the cut-over lands in Washington is west of the Cascade Mountains. These lands have been grouped, for the purposes of this report, according to whether the soils are of glacial or mainly of residual origin. The glacial soil cut-over lands are those surrounding Puget Sound and two small areas in northeast Washington, here called the upper Columbia project. The residual soil cut-over lands are those surrounding Grays Harbor and Willapa Bay on the coast and those along the lower tributaries of Columbia River. The acreage suitable for agriculture in the State, as a whole, is estimated to be about 2,025,000. It will doubtless be possible to select feasible projects in this area where the cost of clearing is not excessive and where the agricultural possibilities are good, coupled with satisfactory transportation and markets.

278. *Offers and prices of lands.*—Various lumber companies in the State of Washington have joined forces in making offers to the Government of cut-over lands which they have for sale. The lands are in some 20 parcels and aggregate about 200,000 acres. Also the farm development bureau of the Spokane Chamber of Commerce has similarly submitted tentative offers on behalf of various lumber companies owning cut-over lands in northeast Washington and Kootenai and Bonner Counties, Idaho, aggregating about 188,000 acres. The price of these last-mentioned parcels is stated as "not over $15 per acre." The extreme price range on the other parcels is from $2 to $30 per acre. Raw stump and brush-covered lands are quoted at prices varying from $15 to $50 per acre, and some stump land is held at

from $75 to $125 per acre. Improved farm land is valued at from $200 to $300 or more per acre.

279. *Engineering plans and feasibility.*—The cost of clearing these western cut-over lands is comparatively high, although there is considerable range in cost for the different areas and parts thereof. It is evident, therefore, that in order to prove an economically advisable undertaking, assurance must be had that the net returns from agricultural products will pay interest on the original value of the land, plus the cost of clearing and improving. Such assurance can only be gained by a very careful consideration of each particular contemplated project.

280. *Transportation facilities and towns.*—The railroad, as well as the highway, accommodations in the areas discussed vary so greatly as to prevent detailed consideration here. Western Washington, however, is well traversed by the Great Northern, Northern Pacific, Bellingham & Northern, and Pacific Northwest Traction Railroads, as well as by many spurs and logging roads. The Columbia and many other streams are navigable at least in part and with one exception each area has two or more railroad lines crossing it as well as numerous branch lines. These are supplemented in many instances by electric lines. Willapa and Grays Harbor, as well as numerous ports on Puget Sound and the Columbia River, give most excellent shipping facilities. The whole area is also practically a network of State roads. The areas under discussion include, or are adjacent to, all the large cities and towns of western Washington, which will furnish local markets for farm produce. The Vancouver area is practically all within a 50-mile zone of Portland, Oreg., with particularly good transportation facilities throughout. The various ports also furnish an easy means for export trade to all parts of the world. Seattle is the metropolis of the section, while a few of the other larger cities are Tacoma, Portland, Everett, Bellingham, Port Townsend, Aberdeen, Vancouver, and Chehalis.

CUT-OVER LANDS WITH GLACIAL SOILS.

281. *Location and acreage.*—These cut-over lands may be divided into the Pugent Sound projects designated as the Totten, Nisqually, Seattle, Everett, Skagit, and Nooksak projects, and the upper Columbia project in northeast Washington, comprising the Loon Lake and Newport tracts. These latter tracts lie in Stevens and Pend Oreille Counties, while the former are in Mason, Thurston, Pierce, King, Snohomish, Skagit, and Whatcom Counties, south and east of Puget Sound. The gross acreages of agricultural cut-over lands of these two main divisions are respectively 515,000 and 122,000 acres.

282. *Soils and agricultural possibilities.*—The soil of the river-bottom lands is largely made up of alluvial deposits, which are often of high fertility and productiveness. The upland soils are mostly of glacial origin, occurring in varying depths and of different degrees of fertility. They consist of a sandy loam with an average depth of 10 to 15 inches and contain a large number of small, rounded, iron concretions which weather readily. Rounded gravel, varying from coarse sand to stones 4 or 5 inches in diameter, occurs largely, but not in sufficient quantity to classify the soil as a gravelly

loam. The subsoil consists of a mass of rounded glacial gravel imbedded in a medium to coarse gray sandy loam. Gravel, coarse, and fine sand and silt often occur in more or less extensive beds or pockets or in layers varying from 1 to 5 feet in thickness. In general, the cut-over lands are adapted to dairying, poultry raising, stock raising, and general farming.

283. *Detailed information on areas.*—Additional data relating to the several projects of the glacial group are given in the following paragraphs.

284. *Everett project.*—This area embraces the lower part of the drainage area of the Snoqualmie River and also those of the Snohomish, Skyhomish, and Stilaquamish Rivers, and lies between the Puget Sound and the rough country along the slopes of the Cascade Mountains. There is a strip of coast land, then a greatly rolling and gradually ascending upland intersected here and there by sharper-sloped ridges and irregular areas of mesa land. The area has the prevailing Puget Sound climate. The soils are largely gravelly and sandy loam throughout the upland country, and silts and clay loam in the lowlands. There are 125,000 acres considered suitable for agriculture, of which probably 50,000 acres are available for community settlement.

285. *Nisqually project.*—The drainage basin of the Nisqually and Deschutes Rivers in the south and the Puyallup River in the north are included in this area which lies in Thurston and Pierce Counties. The western part of the district and for some distance back from the Sound country is comparatively level but undulating, merging into a more rolling and diversified country. It then ascends into the foothills and bench lands of the Cascades. The stream valleys have varying-sized areas of level land, but these are mostly occupied and in cultivation. One tract of 8,000 to 9,000 acres, known as the prairie lands, is found in the western part of the area. This is a slightly undulating plain interspersed with broad, low, flat-surfaced terraces. Most of this tract is open and treeless. The soil here is shallow and poor, overlying beds of coarse gravel of considerable depth. Under irrigation these soils produce fair returns of some crops. In general, the soils vary from peat and muck soils along the shore lands and at the mouths of the rivers, the alluvial deposits in the valleys, through the various phases of the silt and agrilicious soils and loams, to the shallow gravelly glacial reefs. For the most part, the cut-over lands are fertile. It is estimated that there are about 20,000 acres in the project suitable for agriculture.

286. *Nooksak and Skagit projects.*—These two projects are so similar that a single description will answer for both. They lie, respectively, in Whatcom and Skagit Counties, the former bordering on Canada. They are drained by the Nooksak and Skagit Rivers with delta plains at their mouths. The glacial outwash here is composed of a great variety of materials from huge fragments of broken rock and bowlders, through the gradations of gravel, sand, clay, and silt, to marsh-ooze. Farther back from the shore in the valleys, the soils of the glacial plains are a combination of gravel, sand, clay, silt, and loam, the latter being largely the mould or alluvium eroded from the forest-covered uplands. The agricultural value of these soils depends upon their mixture, but as a rule the lands of

the two valleys are productive. The uplands are more or less diversified and broken, but a considerable portion may be classed as tillable. Both districts are largely forest-covered, much of the timber being of unusual size and quality. The climate is mild and uniform, and the agricultural possibilities include fruits, grains, vegetables, and forage crops. These two tracts contain about 253,000 acres suitable for agricultural.

287. *Seattle project.*—Embracing the western half of King and the peninsula section of Kitsap Counties, this area includes the drainage basins of White River, Green River, Cedar River, and the upper basin of the Snoqualmie with its tributaries. Along the streams are stretches of alluvial lands totaling a considerable acreage. In the upper districts the bordering uplands are precipitous and broken, but the bordering foothills are lower and with rounded slopes quite suitable for farming. The peninsula section across the Sound is comparatively level. The soil is mostly a sandy loam, but in some places runs more to a loamy sand. It contains much organic matter adapting it to market gardening, berry culture, and forage crops, also dairying and poultry raising. The climate is mild and the rainfall large. There are about 105,000 acres of unoccupied agricultural lands in this area.

288. *Totten project.*—This is an area lying in northwestern Thurston and southern Mason Counties, just to the west of the western end of the Nisqually project. Totten Inlet and Eld Inlet extend into this area, the latter forming its eastern boundary. The northern half of the district has gravelly, sandy loam soil and the southern half a loam soil. The precipitation ranges from 60 to 70 inches. Practically all of the area is rough and broken and the reclaimable agricultural area is only about 12,000 acres.

289. *Upper Columbia project.*—The Loon Lake division of this project is located on the headwaters of the Colville River, the southern portion being drained southward through Chamokane Creek and Little Spokane River. The country is, in general, rough, except in the vicinity of Deer Park. The logged-off lands in Stevens County, on Chamokane Creek and the head of Colville River, suitable for cultivation, occupy comparatively extensive level to gently-rolling terraces along these streams, or residual uplands to the westward. The western portion of the area is rolling to hilly. The altitude ranges from 2,000 to 2,500 feet. Precipitation ranges from 18 to 22 inches, and the climate is typical of the inland empire. Crops do better with irrigation. The soils are principally silt loam, varying from silt loam to fine sandy loam with heavy stone content where glaciation occurs. Large orchards are being planted in the Deer Park section, and intensive agriculture is here followed. In the vicinity of Springdale and southward the county is principally adapted to hay for dairy stock and the hardy vegetables. The second division of the upper Columbia project, or Newport unit, is situated principally in Spokane and Pend Oreille Counties.

The northern part of the area is drained by Clarks Fork of the Columbia River. The portion south of Newport is drained southward by the Little Spokane River. The Clarks Fork Valley through the area ranges from 1 to 5 miles in width. The tract is made up for the most part of level gently rolling river terraces of an average

elevation of 2,500 feet and glacial uplands. Throughout this section of Washington and Idaho the valleys are more or less broken and contain large areas of nontillable land; such areas, however, afford good grazing. The climate is tempered by the "Chinook" winds, the winters being mild and the summers temperate, the precipitation varying from 20 to 26 inches. Late-maturing crops do better with irrigation. The soils range from silt loam underlain with silt and sand to a fine sandy loam with a subsoil of gravel and rounded cobbles. Generally speaking, the soil may be classed as a silty fine sandy loam. A considerable amount of intensive farming has been done and various fruits have been successfully grown. In the vicinity of Newport the country is generally adapted to hay crops, especially clover, as well as all kinds of hardy vegetables and root crops. The climate is too cool for corn and melons. The upper Columbia project is estimated to contain about 122,000 acres of unoccupied cut-over lands suitable for agriculture.

CUT-OVER LANDS WITH RESIDUAL SOILS.

290. *Location and acreage.*—There are five of these areas in southwestern Washington, namely, Alochaman, Chehalis, Cowlitz, Vancouver, and Willapa projects, which will be taken up below in detail. Three of the areas border on the Columbia River, while two of them have immediate access to the sea. The estimated unoccupied cut-over lands in these five projects available for agriculture amount to some 690,000 acres.

291. *Soils and agricultural possibilities.*—The residual soils predominate in these areas in the southwestern portion of Washington. They are formed directly from weathering of underlying rocks in place and include soils of the rolling to hilly upland districts and those of the rough mountainous districts. There are alluvial soils of the terraces as well as the recent alluvial flood plains, sedimentary deposits in lake beds, morainic soils, and those derived from organic matter in this section, but all these are of minor occurrence. The soils of the rolling to hilly upland districts are uniformly of fine texture, principally clay loams and silty clay loams. The texture of the fine earth comprising the soil of the rough mountainous districts varies from light loams to silty clay or clay loam. Most of the types carry a large quantity of small angular gravel, bowlders, and large rock fragments both on the surface and in the subsoils. These soils and the climate are adapted to the growing of small grain, potatoes, fruit, and to dairying.

292. *Detailed information of areas.*—In the following paragraphs will be found additional information relating to the natural divisions of the lands considered in the residual soil group.

293. *Alochaman project.*—This tract has a 50-mile frontage on the north bank of the Columbia River, in eastern Wahkiakum County, in the extreme southwest corner of the State. It includes also a small portion of western Cowlitz County. It is mostly an upland country, ranging in elevation from 500 to 1,500 feet above sea level. It is drained by several streams. While somewhat broken and irregular, it is estimated that about one-third of the area is tillable. Only about 50,000 acres have as yet been logged off, of

which 20,000 acres are estimated as suitable for agriculture. The climate is moderate, as in all of the lower Columbia Valley, and well adapted to agriculture of all kinds. The soil of the northern portion is a stony loam, of the southwest portion a silty clay loam, and of the southeast corner a silt loam. The stony loam is usually regarded as too rugged for agriculture, but the silt loam, when accessible, is desirable for farming purposes. The silty clay loam is rolling to hilly land adapted to dairying. Hay, corn, and oats do well. There is little agricultural settlement in this area.

294. *Chehalis project.*—The Chehalis area comprises the drainage-basin of the Chehalis River, the western extremity bordering Grays Harbor. A large part of the district is comparatively level or composed of gently rolling hilly land. The level land along the Chehalis River is very generally occupied and cultivation is extending to the uplands back from the stream. Some open flat tracts are embraced, known as prairies, which are generally of shallow, gravelly, poor soil. The soils of the valley lands are composed of erosion deposits, with a large content of organic matter and humus, while those of the uplands are very generally a clay loam or silty clay loam, with occasional areas where gravel or sand modify or replace the clay. This may be considered as a general farming section, but as July and August are usually practically without rain special cropping or irrigation is necessary. The annual precipitation ranges from 90 inches in the coast section to 50 inches in the eastern portion. The estimated area of unoccupied lands suitable for agriculture is about 222,000 acres.

295. *Cowlitz project.*—This area adjoins and is south of Chehalis district and is practically formed of the Cowlitz River drainage basin. This river is navigable for 50 miles from its confluence with the Columbia River, which forms the southwest border of the district for 45 miles. The lower and larger part of the Cowlitz Basin, varying in elevation from 100 to 1,400 feet, is largely a succession of valleys, the intervening ridges and hills being of easy slope and moderate elevation. The cut-over area is extending rapidly and is estimated to embrace 650,000 acres, of which 268,000 are considered suitable for agriculture. The climate is moderate with long growing seasons and short, temperate winters. The precipitation ranges from 40 to 60 inches. The soils range from the alluvial sediments of the valley floors through the various classes of loams to the shallow soils of the terraces and rocky uplands. The tillable areas have largely the silty clay and clay-loam soils, which are generally rich and fertile.

296. *Vancouver project.*—The Vancouver project is the most southerly district and is bounded for 150 miles on the south and west by the great bend in the Columbia River. It has an area of nearly 2,200 square miles and includes the foothill slopes of Mount Adams and Mount St. Helens, and also the outlying tableland, which in the eastern part extends down to the Columbia River and in the western part merges into the gently rolling hill country of Clark County. The Klickitat and White Salmon Rivers drain the eastern part and the Lewis River the western part. The climate has a large range of variation, the section with the more severe climate being adapted

to fruit raising. The precipitation ranges from 18 inches in the extreme eastern part to 50 inches or more along the Columbia in the western part. The soils are diversified, and while over a very large proportion of the million and a half acres they range from poor to the ordinary, yet throughout the tillable areas they may be regarded as generally fertile. This is attested by the fact that in practically every locality within the area farming of all kinds has for years been carried on with success. Along the stream-flood plains the soil is generally a sedimentary alluvium and that of the adjoining valley lands alluvial and sandy loam, with occasional tracts of gravelly loam. The terraces and outwash bench lands have generally sandy or gravelly soils more or less mixed with loam. The hill country has residual soils from the igneous and basaltic formations. Diversified as well as intensive farming is feasible. The estimated unoccupied acreage of lands suitable for agriculture is 120,000 acres.

297. *Willapa project.*—This area surrounds Willapa Bay in the southwest corner of the State, and besides the western slopes of the Coast Range in the Willapa drainage basin it also includes the eastern slopes of the same range. Of the 800 square miles about 40 per cent is already logged off or burned over. Along the coast and for some distance inland the country is comparatively level, and back of this strip it is mostly a rolling hilly country, becoming rougher and more broken toward the crest of the mountains. The altitude ranges from tidewater to 1,200 feet, except the mountains, a few of which have elevations of 2,400 to 2,500 feet. The climate is mild and favorable for agricultural production. The precipitation ranges from 40 to 80 inches, with little snowfall. The soils vary from black muck or peaty mold on the lowlands to a black clay loam, and then a sandy loam as higher altitudes are recorded. Early fruits and vegetables are especially adapted to this district, as are poultry and dairying. The unoccupied acreage suitable for agriculture is 60,000 acres.

TABLE 36.—*Agricultural cut-over lands in Washington.*

Project.	County.	Acreage suitable for agriculture.	Estimated acreage available for community settlement.
Vancouver	Clarke, Cowlitz, and Skamania	120,000	60,000
Cowlitz	Cowlitz and Lewis	268,000	100,000
Alochaman	Wahkiakum	20,000	10,000
Willapa	Pacific	60,000	30,000
Chehalis	Lewis, Thurston, and Grays Harbor	222,000	100,000
Totten	Thurston and Mason	12,000	10,000
Nisqually	Thurston and Pierce	20,000	10,000
Seattle	Pierce and King	105,000	50,000
Everett	Pierce and Snohomish	125,000	50,000
Skagit	Skagit	128,000	50,000
Nooksak	Whatcom	125,000	50,000
Upper Columbia	Stevens, Spokane, and Pend Oreille	122,000	50,000
Total		1,327,000	570,000
Other areas	Various	698,000	.....
Estimated total in State		2,025,000	.....

TABLE 37.—*Classified acreages of unoccupied cut-over lands in various counties in cut-over region of Washington.*

County.	Area of unoccupied cut-over lands.	Area most suitable for agriculture.	Area most suitable for grazing.[1]	Prevailing price of cut-over lands.
	Acres.	*Acres.*	*Acres.*	
Chehalis [2]	162,000	72,900	.....	$8–$40
Clallam [2]	135,000	50,000	57,400	8– 50
Clarke [2]	82,500	50,000	.....	35–125
Cowlitz [2]	300,000	200,000	.....	10– 40
Ferry [3]	10,000	4,500	.....	5– 30
Grays Harbor [2]	384,100	8,000	3,300	.....
Island [2]	112,800	50,800	.....	10– 40
Jefferson [2]	106,000	55,000	88,800	10– 40
King [2]	88,600	50,000	3,100	35–150
Kitsap [2]	140,500	75,000	.....	12–150
Klickitat [3]	10,000	500	.....	20– 50
Lewis [2]	472,200	236,000	13,700	10– 50
Mason [2]	200,000	200,000	19,500	10– 35
Okanogan [3]	10,000	4,500	.....	5– 10
Pacific [2]	207,200	75,000	.....	20– 50
Pend Oreille [3]	80,000	65,000	.....	.....
Pierce [2]	120,000	90,000	78,300	10– 50
San Joan [2]	7,500	7,500	.....	10– 50
Skagit [2]	213,000	127,800	10,500	40–150
Skamania [2]	40,000	20,000	29,600	20– 50
Snohomish [2]	210,000	100,000	23,500	15–100
Spokane [3]	200,000	120,000	.....	15– 30
Stevens [3]	788,000	197,000	.....	3– 35
Thurston [2]	50,000	25,000	.....	10– 50
Wahkiakum [2]	95,000	20,000	.....	15– 50
Whatcom [2]	251,900	125,000	55,000	20– 75
Total	4,476,300	2,024,500	382,700	.....

[1] Private lands and national forest. [2] West Washington. [3] East Washington.

WISCONSIN.

GENERAL STATEMENT.

298. *Scope and results of investigation.*—It is estimated that there are approximately 3,800,000 acres of undeveloped swamp lands in Wisconsin and approximately 7,500,000 acres of unoccupied cut-over lands. Of this area of cut-over lands approximately 5,000,000 acres are considered suitable for agricultural development and about 1,250,000 for grazing. The unoccupied cut-over area of the State lies principally in 27 counties in the northern part of the State, partly within the drainage area of Lake Superior, partly within the drainage area of Lake Michigan, and partly within the drainage area of the Mississippi River. Two areas, one containing 100,000 acres lying in Douglas County, called the Douglas County project, and one lying in Taylor County, containing 20,000 acres, called the Mondeaux project, have been selected for consideration. These areas will be briefly described in the following pages. Numerous other areas of equal quality can be selected in various parts of the northern portion of Wisconsin. Twenty-one different swamp-land areas of considerable magnitude were investigated and a number of these projects are considered suitable for development. Some of them have been organized into drainage districts and considerable work has been done on them. It is believed that some of these partially developed areas can be economically completed with Government funds and used for settlements. Other areas that have not yet been undertaken offer equally as attractive opportunities. Of these untouched areas three have been detailed for discussion, known respectively as the Chippewa project in Rusk County, the White

River project in Bayfield County, and the Bark River project in Jefferson and Waukesha Counties. The estimated total area of swamp lands in Wisconsin is 3,803,000 acres.

299. *Offers and prices of land.*—A large number of offers of land for soldier-settlement purposes were received from various parties holding lands in the State. These tracts varied in size from about 3,000 to 70,000 acres and the prices asked varied from $5 to $50 per acre. The total acreage offered was 968,000 acres. Considerably over 50 per cent of the unoccupied cut-over lands in the State are held in large ownerships and there should be no difficulty in securing in Wisconsin a large number of excellent projects, with good soils and compactness of area.

300. *Soils and agricultural possibilities.*—The entire northern and eastern parts of the State of Wisconsin were affected by glaciers and practically the entire area was covered by the most recent glacial invasion. The soils of this region conform, therefore, in general to the characteristics of the soils of the entire Great Lakes group of cut-over lands, belonging either to the glacial province or to the glacial lake province. The soils of the glacial lake province are found principally along the shores of Lake Superior in the vicinity of Superior, Bayfield, and Ashland, and in the area surrounding Lake Winnebago and Green Bay, and in a narrow strip along the west shore of Lake Michigan. The glacial province covers practically all of the remainder of the entire State, with the exception of about 13 counties in the southwestern part of the State. Within the glacial area the soils consist of gravel, sands, and loamy and clayey tills of the usual glacial types. Within the glacial lake province the soils consist of a red clay sometimes overtopped with sands or sandy loams. The winters of northern Wisconsin are cold and dry and the summers are warm. Precipitation ranges from about 32 inches in the lower elevations of the State to about 44 inches in the higher elevations. A large percentage of this precipitation falls during the growing season from April 1 to September 30. This State is seldom injured agriculturally by extreme drought or extreme precipitation. With the exception of the higher parts of the State, the whole region has an exceptionally long growing season. The soils and the climate are well adapted to the growing of all kinds of grasses, clovers, small grains, vegetables, and hardier fruits. Clovers and grasses grow exceptionally well in this region. Dairying is rapidly becoming an important farming industry and the whole region is well adapted to this type of farm industry.

LANDS NEEDING DRAINAGE.

BARK RIVER PROJECT.

301. *Location and acreage.*—The Bark River project contains approximately 20,000 acres in two swamp areas in the drainage basin of Bark River, partly in Waukesha and partly in Jefferson Counties.

302. *Soils and agricultural possibilities.*—The surface soil consists of peat with a depth varying from 2 to 8 feet and a subsoil of sand or sandy clay with occasional beds of marl. The deeper peat soil will quite likely have to be fertilized with potassium and possibly phosphorus to insure good agricultural results; otherwise the agricultural possibilities are considered to be good. These lands should be suitable for growing grasses, clovers, and grains, as well as root

crops of all kinds. Most of the land within the limits of this project is held in small ownerships.

303. *Engineering plan and feasibility.*—The outlet for drainage works for this project is the Bark River and there appears to be sufficient fall in the river and from the surrounding lands to the river to make the drainage of the project an easy matter. Open lateral ditches from the river into the body of the land, together with tiling, will be necessary to complete the drainage of the area.

304. *Transportation facilities and towns.*—The lands referred to in this report are traversed by the main line of the Chicago & Northwestern Railroad between Milwaukee and Madison. The towns of Sullivan in Jefferson County and of Dousman in Waukesha County are on this railroad adjacent to the swamp lands. The area is not far distant from Waukesha and Jefferson, the county seats of the counties of their respective names. Moreover, the whole area is within a short distance of Milwaukee and Chicago.

CHIPPEWA PROJECT.

305. *Location and acreage.*—The Chippewa project contains about 10,000 acres of land, lying between the Chippewa and Flambeau Rivers southwest of Ladysmith in Rusk County.

306. *Soils and agricultural possibilities.*—This tract of land consists of swamp land intermingled with islands or higher lands so interspersed that in a farm of the usual size there would be both swamp and highland. The swamp lands are largely of the open type and have a peat soil varying from shallow to deep. The soil of the highlands and the subsoil of the marsh lands consist of sandy loam with a large proportion of fine to coarse sand and a small proportion of silt and clay. The leveler stretches adjacent to the rivers are more sandy and were originally timbered with pine, while the more undulating areas, containing a larger proportion of fine sand and silt, were originally timbered with hardwoods mixed with pines. These upland soils are, with proper use of leguminous crops, well adapted to the growing of both root crops and grains and grasses. Potash, lime, and possibly also phosphorus, may be needed to render the peat soil fertile.

307. *Engineering plan and feasibility.*—The natural drainage for the swamp lands is west into the Chippewa River and the possibility of drainage at reasonable expense appears to be evident. Open ditches extending from the river into the lands with supplemental tile lines will be necessary to accomplish the reclamation. The uplands and the dryer portion of the swamp land will have to be cleared of brush and stumps before they can utilized for cultivated crops.

308. *Transportation facilities and towns.*—The main line of the Sault Ste. Marie Railroad extending from St. Paul to Sault Ste. Marie passes along the northern border of this area. The towns of Bruce and Ladysmith are located near the area, the latter being the county seat of Rusk County.. Local markets and markets at St. Paul and Minneapolis will be available for products raised in this region.

WHITE RIVER PROJECT.

309. *Location and acreage.*—The White River project is located in the upper drainage basin of White River near the center of Bayfield County and contains approximately 18,000 acres of swamp land.

310. *Soils and agricultural possibilities.*—About one-half of the soil consists of deep peat, and about one-half of shallow peat and sandy loam resting on a subsoil of red clay. The sandy loam soil and the shallow peat soil will make fertile farms from the outset. The deep peat soil, however, will require the application of potassium and possibly of phosphorus and lime in order to make it productive for all classes of crops. The soil when drained should be suitable for growing small grains, grasses, clover, peas, and all kinds of root crops.

311. *Engineering plan and feasibility.*—The drainage of these lands will require the removal of the dam on White River at Mason, the cleaning of the river channel for some distance above the dam, the constructing of large open ditches into the swamp areas, and the connecting of these main ditches with the farm lands by means of tile lines. The vegetation on the deep peat soil consists of dead tamarack, cedar, and spruce intermingled with poplar, birch, willow, and alder brush. The vegetation on the shallow peat adjacent to the streams consists of elm, ash, and tamarack, with a thick undergrowth of alders and willows, and in the areas more distant from the streams, with blue-joint grass, dead tamaracks, and small clumps of poplars and alders with intermingled willow brush. The clearing can be readily and economically accomplished. Vegetation on the sandy loam consists of grasses and clumps of poplar and willow brush.

312. *Transportation facilities and towns.*—The area of this project is bounded on the north by the main line of the Duluth & South Shore Railroad, and the Chicago, St. Paul, Minneapolis & Omaha Railroad, running from St. Paul to Ashland, crosses the eastern end of the project. The small towns in the project are Sutherland, Bibon, Grandview, and Mason. The entire area is located within a short distance of Ashland, Superior, and Duluth, and is not far distant from St. Paul and Minneapolis.

CUT-OVER PROJECTS.

DOUGLAS COUNTY PROJECT.

313. *Location and acreage.*—The Douglas County project contains approximately 100,000 acres of land lying in the southwestern part of Douglas County. This area is situated on the divide between the drainage basin of Lake Superior and that of St. Croix River and in the vicinity of the headwaters of numerous small streams of these drainage basins.

314. *Soils and agricultural possibilities.*—The soil of the larger part of the area consists of a silt loam with a subsoil of sandy loam. This soil is generally acid, but has sufficient porosity for good drainage. A considerable area in the southwestern part of the tract has a silty loam soil with a subsoil of silty material. Chemical analyses show the quantities of plant foods of this soil satisfactory with the exception of phosphorus. Scattered throughout the entire area are numerous depressions with peat and muck soils. The surface of the loam soil is gently rolling while that of the silt loam varies from level to rolling. These soils are adapted to the growing of small grains, grasses, potatoes, silage corn, and small fruits, and also of clovers when treated for acidity. This region is especially well adapted to dairying.

315. *Engineering plan and feasibility.*—The original vegetation of the uplands of this entire area consisted of the various hardwoods, hemlock, and white pine. In the swamp areas the original vegetation was mainly tamarack, cedars, spruce, and ash. The pine and some of the hemlock and hardwoods have been removed from these lands. The problem of reclamation, therefore, is the usual one of clearing connected with incidental drainage of some of the low depressions or swamps. Sufficient slope for outlets for the swamp lands usually exists.

316. *Transportation facilities and towns.*—The Minneapolis, St. Paul & Sault Ste. Marie Railroad, running from St. Paul to Superior and Duluth, passes near the western edge of the entire tract and through the northern part thereof, while a branch of the Chicago, Milwaukee & St. Paul Railroad passes along the eastern part of the tract. There are a few roads and small towns within the main body of the tract. Several railroad towns of considerable importance are not far distant from the edges of the tract, and the whole tract is within easy reach of the markets of Minneapolis, St. Paul, Duluth, and Superior.

MONDEAUX PROJECT.

317. *Location and acreage.*—The Mondeaux project is located mainly within the drainage basin of Mondeaux Creek, in the north-central part of Taylor County, and it contains approximately 20,000 acres of land.

318. *Soils and agricultural possibilities.*—The general surface of this tract varies from level to undulating and rolling, the northern part of the tract being level to undulating and the southern part undulating to rolling. The soil in the northern part is a silt loam, with a subsoil varying from silt loam to silty clay loam. The soil is deficient in nitrogen and is generally acid in character. There are some bowlders and stones scattered over the surface of the ground, but they are not sufficient in number to interfere with cultivation. The soil in the southern part of the area consists of a clay loam, with a subsoil of bowlder clay. The rougher parts of this land contain considerable numbers of bowlders, while those of the more gently sloping and undulating lands have few bowlders that will interfere with cultivation. Under proper farming methods and fertilizing treatment of the soils this region is adapted to the growing of small grains, grasses, clovers, potatoes, garden truck, and small fruits. The southern and rougher part of the area will also grow successfully some of the hardier tree fruits.

319. *Engineering plan and feasibility.*—The general problem of reclamation of these lands consists of clearing, with a small amount of incidental drainage. The original vegetation consisted mainly of hardwoods and hemlocks, with a few scattering white pines. The pines have all been cut, and portions of the hardwoods and hemlocks have also been removed.

320. *Transportation facilities and towns.*—The Ashland and Chicago branch of the Minneapolis, St. Paul & Sault Ste. Marie Railroad passes within a few miles of the eastern border of this tract of land, and the St. Paul & Sault Ste. Marie branch of the same railroad passes a few miles to the north thereof. Highways within the body of the land are meager. Chelsea, Westboro, Ogema, Prentice, and

Kennan are the principal towns in the vicinity of the tract. Railroad connections with Minneapolis and St. Paul are good.

TABLE 38.—*Lands needing drainage in Wisconsin.*

Project.	County.	Acreage.
Barber Lake	Sawyer	6,000
Bark River	Jefferson and Waukesha	20,000
Chippewa	Rusk	10,000
Glacial Lake	Wood and others	270,000
Manitowoc	Calumet and Manitowoc	10,000
Peshtigo	Oconto	17,000
White River	Bayfield	18,000
Other areas	Various	3,452,000
Estimated total in State		[1] 3,803,000

[1] These figures were furnished by the Office of Public Roads and Rural Engineering, U. S. Department of Agriculture.

TABLE 39.—*Agricultural cut-over lands in Wisconsin.*

Project.	County.	Acreage suitable for agriculture.	Estimated acreage available for community settlement.
Douglas County	Douglas	100,000	75,000
Mondeaux	Taylor	20,000	10,000
Total		120,000	85,000
Other areas	Various	4,880,000	.....
Estimated total in State		5,000,000	.....

NOTE.—Probably 2,500,000 of this area could be utilized for community settlements.

TABLE 40.—*Classified acreages of unoccupied cut-over lands in various counties in cut-over regions of Wisconsin.*

County.	Area of unoccupied cut-over lands.	Area most suitable for reforestation.	Area most suitable for agriculture.	Area most suitable for grazing.	Prevailing price of cut-over lands.
	Acres.	*Acres.*	*Acres.*	*Acres.*	
Marinette	445,020	34,100	223,120	187,800	$10–$30
Florence	140,000	10,000	90,000	40,000	15
Forest	525,000	100,000	395,000	30,000	20
Oneida	226,100	60,000	106,100	660,000	8
Iron	375,100	15,000	335,100	25,000	10
Vilas	417,000	80,000	257,000	80,000	5
Ashland	400,000	.....	265,000	135,000	25
Bayfield	653,400	185,000	463,400	5,000	5– 20
Douglas	400,000	100,000	300,000	.....	15– 25
Burnett	80,000	60,000	15,000	5,000	10– 15
Washburn	100,000	37,000	60,000	3,000	15– 25
Sawyer	585,000	135,000	350,000	100,000	12– 30
Price	624,334	65,000	509,334	50,000	10– 15
Lincoln	384,000	100,000	200,000	84,000	20
Langlade	112,000	10,000	50,000	52,000	5– 30
Oconto	450,000	100,000	200,000	150,000	25
Shawano	200,000	25,000	120,000	55,000	15– 40
Marathon	235,000	1,000	233,000	1,000	12– 18
Taylor	135,000	5,000	125,000	5,000	9– 30
Chippewa	265,129	79,538	132,565	53,026	20– 25
Polk	69,120	9,620	50,000	9,500	16
Clark	108,480	1,000	106,480	1,000	10– 20
Eau Claire	74,000	3,000	68,000	3,000	10– 15
Dunn	21,000	1,000	19,000	1,000	15– 30
Door	50,000	5,000	42,000	3,000	10– 25
Jackson	200,000	75,000	25,000	100,000	10– 20
Husk	218,000	45,000	171,000	2,000	15– 25
Total	7,492,638	1,341,258	4,911,099	1,240,326	.....